Technical
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HumRRO-TR-80-1

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LEVEL II 6

Instructional System Development (ISD) In the Armed Services: Methodology and Application

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January 1980

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: HumRRO-TR-80-1 / HUMRRO-FR-WD-CA-79-2	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): INSTRUCTIONAL SYSTEM DEVELOPMENT (ISD) IN THE ARMED SERVICES: METHODOLOGY AND APPLICATION,	5. TYPE OF REPORT & PERIOD COVERED: Final Report. 25 Aug 77 — 19 Mar 79
	6. PERFORMING ORG. REPORT NUMBER: FR-WD-CA-79-2
7. AUTHOR(S): Robert Vineberg, John N. Joyner	8. CONTRACT OR GRANT NUMBER(S): MDA 903-77-C-0335
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Human Resources Research Organization, 300 North Washington Street, Alexandria, Virginia 22314	10. PROGRAM ELEMENT PROJECT TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: OASD (MRA&L) Program Management, Room 3E772, Washington, D.C. 20301	12. REPORT DATE: January 1980
	13. NUMBER OF PAGES: 142 / 143
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Instructional System Development
ISD
Systems Approach to Training
Systems Engineering of Training
Training Development
Training Technology
Training Evaluation
Cost-Effectiveness of Training
Training Design
Instructional Design
Instructional Technology
Training Objectives

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The study examined Instructional System Development (ISD) methodologies and practices in the Army, Navy, Marine Corps, and Air Force during Aug 1977-Mar 1979. Findings are based on (1) analysis of the primary guidance documents used in the Armed Services for conducting ISD, (2) questionnaire survey of 209 units, agencies and schools where training is developed in the Services, and (3) detailed interview of training developers at 33 organizations to determine how 57 courses were designed. Major findings are that ISD is

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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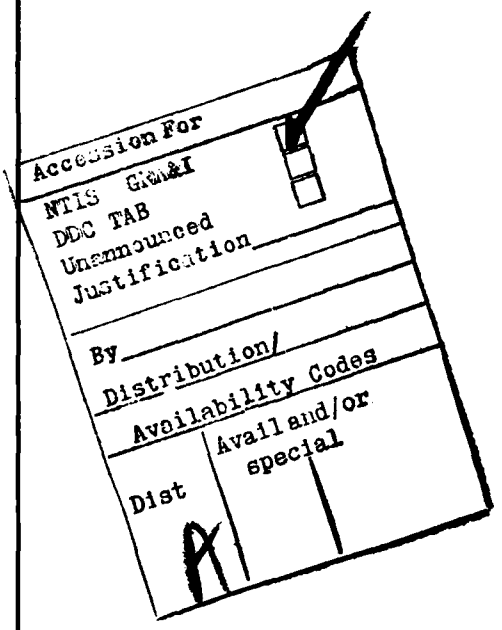
20. Abstract (continued)

not being used either to optimize total system effectiveness or to maximize training efficiency.

The iterative and derivative character of the methodology can insure that training will be relevant to job requirements if its procedures are faithfully carried out. In practice, however, many of the components of ISD are omitted and the close connection between components to make the process truly derivative is not maintained. Thus the potential of ISD to insure that training meets job requirements is not being realized. The conception of ISD that is most adequately represented in current applications of ISD is as the use of specific elements of modern training technology, i.e., job analysis, self-paced instruction. Considerable evidence leads to the conclusion that although the generation of the products of ISD can be mandated, the ISD process itself cannot. Training is both developed and evaluated within the training subsystem, whereas the consequences of training occur in operational units. It is recommended that operational commands be given a larger role in identifying job requirements, establishing training requirements, and evaluating the performance of training graduates. The report also contains findings and recommendations for 19 specific steps of the ISD process.



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Instructional System Development (ISD) In the Armed Services: Methodology and Application

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Prepared for:

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PREFACE

This report is an analysis by the Human Resources Research Organization of Instructional System Development (ISD) methodology and of practices observed in its application in the Army, Navy, Marine Corps, and Air Force. The research was conducted under Contract No. MDA 903-77-C-0335 for the Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics. The work was monitored at different times by Colonel George P. Tilson, Ms. Jeannie Fites, and Major Ken Rousseau, all of OASD (MRA&L). Their assistance is gratefully acknowledged.

The research was performed by HumRRO Western Division at Carmel, California, Dr. John E. Taylor, Director. The Principal Investigator was Dr. Robert Vineberg; Research Associate was Mr. John N. Joyner, who contributed to all phases of the study and writing of the final report.

The authors wish to acknowledge the cooperation and assistance of the many persons—officers, enlisted men, and civilians—who provided information about the use of ISD in the military services. Their number precludes mention by name. However, special mention should be made of these persons who arranged for the distribution of the ISD survey questionnaire: Army - Dr. Joseph Kanner, Training and Doctrine Command; Navy - Dr. Worth Scanland, Office of the Chief of Naval Education and Training, Commander Joe Funaro, Naval Training Equipment Center, and Commander Paul Chatelier, Naval Air Systems Command; Marine Corps - Lt. Col. E.A. Grimm, Headquarters, Marine Corps; Air Force - Maj. George Hittle, Air Staff Operations and Readiness.

SUMMARY AND RECOMMENDATIONS

PROBLEM

The Army, Navy, Marine Corps, and Air Force all prescribe a similar sequence of procedures for the development of training. These procedures, called Instructional System Development (ISD), are characterized by:

(1) Rigorous derivation of training requirements from job requirements. Training requirements are to be selected so as to maximize the combined effectiveness of the training and non-training components of a total operational system.

(2) Selection of instructional strategies to maximize the efficiency of training.

(3) Iterative trial and revision of instruction during development until training objectives are met.

ISD, a systems approach to training development, has many potential advantages, but it is demanding to carry out. It requires sustained commitment to a repetitive process of analysis, design, verification, and revision. Experience in attempts to institutionalize such a process has tended to reveal problems.

This study, performed for the Office of the Assistant Secretary of Defense (MRA&L), examined ISD methodologies and practices in the four Services to seek answers to the questions:

- Do current methodologies as represented in the major guidance documents used in the Services provide the means for attaining the goals of ISD?
- Do current applications of ISD reflect these goals?
- How can ISD methodologies and applications be made more effective?

APPROACH

The absence of reliable criteria of system performance precludes any attempt to evaluate the effects of ISD on performance of the total operational military system. The study focuses instead on the training subsystem, and within this subsystem it is restricted primarily to an analysis of methodology, process, and intermediate products as they bear on ISD.

The analysis is based upon information developed in three major activities:

- Analysis of the primary documents currently in use in the Army, Navy, Marine Corps, and Air Force for guidance in conducting ISD.
  - — *Interservice Procedures for Instructional Systems Development* (1975), published by the Army as TRADOC Pamphlet 350-30, and by the Navy as NAVEDTRA 106A. Developed for the Army and later approved by the Interservice Committee on Instructional Systems Development. Contains detailed procedures for conducting ISD. Known as the ITRO model.
  - — Marine Corps Order P1510.23B (1978). A greatly reduced version of the ITRO model, incorporating documentation requirements specific to the Marine Corps.

— Air Force Pamphlet 50-58, *Handbook for Designers of Instructional Systems* (1973-1974). Detailed procedures for implementing the concepts of AF Manual 50-2, an overview of the ISD process.

- Questionnaire survey of 209 units, agencies, and schools where instruction is developed in the four Services.
- Detailed interview of training developers at 33 of the organizations surveyed to determine how 57 specimen courses were designed.

A generalized ISD model composed of 19 training development steps was used to provide a structure for analyzing and organizing the information obtained, and summarizing findings about ISD practices. The steps and requirements of this generalized ISD model were derived in part from synthesizing the Service models, and in part through rational analysis of the intended functions of those models.

GENERAL FINDINGS AND RECOMMENDATIONS

Judgments about the adequacy of Instructional System Development, its representation in the Service models, and the way it is currently being applied depend on one's conception of what ISD is and what it is expected to accomplish.

The most general way to define ISD is as a *means of designing training to optimize total system effectiveness.* Criteria do not exist for measuring total system effectiveness; ISD is not being used to achieve, nor can it be expected to result in, optimizing the effectiveness of the total system.

A more circumscribed view of ISD is as a *methodology for maximizing training efficiency within the training subsystem.* However, information about the effectiveness and costs of different training strategies is far from complete, and a trial-and-error approach to maximizing efficiency is not practical, given the number of possible combinations of methods. While ISD does provide a framework for comparing alternative training strategies, it is not currently being used, nor can it be regarded, as a methodology for maximizing training efficiency.

A more highly focused view is that ISD is a *methodology for insuring that training is relevant to the job.* Its iterative and derivative character virtually assures that training will be relevant if available procedures are faithfully carried out. In practice, however, many of its components are omitted, and the close connection between components that is essential to make the process truly derivative is not maintained. Most important, the testing and revision necessary to insure job relevance generally do not occur. The potential of ISD to insure that training meets job requirements is not being realized.

A final conception of ISD is that it is synonymous with the *use of modern training technology.* Any of the steps in the training development process are a part of modern training technology, and so are any of those particular training and evaluation methods currently being emphasized (e.g., self-paced instruction, computer-managed instruction, criterion-referenced testing). This definition of ISD is clearly the least demanding, since in essence it holds that undertaking any training development step or using any such training or evaluation method constitutes ISD. It is the definition that is most adequately represented in current applications of ISD.

In summary, then, two effects of ISD are currently possible: *insuring that training meets job requirements* and *promoting the use of modern training technology.* The former, which is clearly the more desirable, is not being achieved. The ISD modes does provide the methodology for making training relevant, but the mere existence of the model does not compel trainers to follow it. Trainers are relatively free, within fairly broad limits, to determine the extent to which they will conform to the ISD process and actually use its products in designing training. For example, front-end analysis may be undertaken, but its results can be and frequently are ignored. Training objectives often are developed with indifference to, or in ignorance of, actual task requirements. Many tests and instructional materials are developed without regard to training objectives. Information about the performance of trainees, once collected, is often not used to revise training, and feedback about graduates, if initiated, is often not acted upon.

Because ISD is a process, it is difficult to observe directly. The occurrence of a process is generally inferred from the presence or absence of its products. In the case of ISD, however, the mere existence of its products—job task lists, training objectives, achievement tests, and the like—does not by itself indicate that they have been used in training development. Considerable evidence that many ISD products remain unused leads to the conclusion that, while the generation of these products can be mandated, the ISD *process* and the appropriate use of the products during training development cannot.

Similarly, a routine allocation of responsibilities in ISD does not necessarily guarantee that these responsibilities will be recognized, accepted, and carried out. For example, ISD methodology requires developers to specify the way in which proficiency will be developed or mediated for all job tasks—immediately, through entry training; later, through advanced training or job experience; or through direct support of job performance by procedural aids or other means. Yet this requirement is frequently ignored. ISD is generally conducted to develop training for only one particular setting, and the manner in which skill will be acquired for tasks that are <u>not</u> selected for training in that setting is usually not specified. Even where skills were explicitly identified for later acquisition, the present study found little evidence either that means were developed for subsequent training or that operational units were informed of their responsibilities for insuring that these skills be acquired. (This observation is based on training development within the training subsystem. The present study did not examine training developed or conducted in operational units. Possibly such an examination would indicate that training for job skills in these units is being conducted in a more comprehensive manner than was suggested by the evidence in the present study.)

The current failure of ISD applications to insure that training meets job requirements, then, is largely due not to inadequacies in the methodology, but to omissions and to failure to use its products in a way that makes the process truly derivative. An implication of these findings is that future efforts to implement ISD should concentrate on finding ways to maintain the integrity of the model.

The findings of the study do not of themselves indicate how to assure rigorous adherence to what is clearly a very demanding model, but they do suggest that introducing changes solely within the training subsystem is not likely to have any great effect. The data strongly suggest the need for checks and balances to guard against omissions in the ISD process and failures to use the ISD products. It would appear logical, therefore, to provide for an expanded role by operational commands—the party directly affected by shortcomings in training, and best able to assess the effects of training.

Such an expanded role for operational commands is, in fact, implied by the model itself. The derivative and iterative aspects of ISD depend on feedback and exchange of information between trainers and users. It is difficult to see how ISD could be more rigorously applied unless such an exchange takes place. In principle, the training subsystem seeks information about field requirements and performance as the foundation on which training is constructed. In practice, however, the study found that the training subsystem does not have this basic orientation, often giving insufficient attention to the effective use of this information. It is reasonable to suggest that a balanced relationship—one that fosters active participation by, and communication between, operational and training commands—is essential to the ISD process.

The following recommendations define the means by which operational commands can assume a greater role. Under these recommendations, operational commands would participate to the greatest extent in those parts of ISD where job performance is represented and where job performance requirements are translated into training requirements. Those parts of ISD concerned with the design of instructional strategies to meet training and job requirements would remain the province of the training community.

It is recommended:

(1) *That job requirements* (skills and knowledge required for successful job performance) *be jointly defined, and agreed to, by training and operational commands.* This recommendation is a prerequisite to Recommendation 2, and to all subsequent training development activities. If successful dialogue, negotiation, and agreement are to follow, training requirements must be based on a mutually agreed-upon definition of job requirements.

(2) *That training requirements* (skills and knowledge to be available at the conclusion of training) *be jointly defined, and agreed to, by training and operational commands.* Such an agreement should identify the specific tasks and standards to which proficiency will be developed, and should delineate the respective responsibilities of the two parties. This includes providing a means for bringing job incumbents to the desired level of proficiency whenever agreed-upon training requirements do not match job requirements.

(3) *That operational commands be required to evaluate the performance of training graduates, and report their findings to the training commands.* Unless operational commands evaluate performance, feedback from users to trainers will not have a sound basis. Without reliable information about the effects of training, specification of training requirements will not serve its purpose.

(4) To implement Recommendation 3, *that task-specific criteria for evaluating the performance of graduates, including methods and standards to be employed, be jointly defined, and agreed to, by training and operational commands.* Evaluation criteria should be at the task level of specificity to permit clear and useful diagnosis of training. More general evaluations are of little use in isolating the causes of inadequate performance. Evaluation criteria must be jointly agreed to if the results of evaluations are to be accepted as valid, and acted upon.

Giving the operational commands a greater role in both establishing training requirements and determining whether requirements have been met will not of itself guarantee that ISD procedures will be rigorously applied to the development of training. It will, however, increase the involvement of those who have the most fundamental interest in seeing that training has been adequately designed and conducted.

So long as training development and evaluation are regarded as a separate activity of the training commands, there is little reason to expect that ISD will be applied any more effectively than under the present conditions. If training and operational commands share these activities—each making its specialized contribution to complement the work of the other—the potential of the ISD process for improving training will be enhanced.

FINDINGS AND RECOMMENDATIONS FOR SPECIFIC ISD STEPS

Need/Discrepancy Analysis

Findings

1. Methodology - Present ISD models do not include procedures for identifying problems in existing training and for identifying a need to undertake ISD. Guidance is needed on how to identify discrepancies between existing training and the field requirements for a job, and how to revise training short of undertaking the entire ISD process.
2. Application - ISD is not generally initiated in response to specific discrepancies between training and field requirements.
3. Application - ISD is usually initiated in response to a directed change (e.g., provide individualized and self-paced instruction) or to a requirement to revise existing training in accordance with ISD methods.

Recommendations

1. Where existing training is being examined, ISD methodologies should emphasize evaluating and improving the training, rather than simply assuming that development of a new course is appropriate. At present new courses are rarely evaluated any more rigorously than the ones they replace.
2. To increase the emphasis on evaluation and improvement, specific procedures should be developed both to identify faults in existing training and to determine efficient boundaries for the ISD process.

IDENTIFICATION OF JOB REQUIREMENTS

Findings

1. Methodology - Current guidance for identifying job requirements permits considerable latitude in the approach taken and the level of description used, with resulting variation in the reliability and utility of the information developed.

2. Application - Job analysis is usually confounded with the selection of tasks for training. Emphasis is not given to independently specifying requirements *as they exist in the job.*

3. Application - Job task lists from occupational surveys (e.g., CODAP, NOTAP) are sometimes available. The information provided by such lists, however, is often in part about classes of activities rather than about tasks, and to that extent may not serve as an adequate base for deriving training. Often, complete task lists are not developed.

Recommendation

1. Training developers should be required to provide and maintain a description of job task requirements distinct from a listing of tasks selected for training. This would make explicit the extent to which training requirements differ from job requirements.

Selection of Tasks for Training

Findings

1. Methodology - There are no measures of system effectiveness that can be used to validate criteria for selecting tasks for training, and rules for applying such criteria. As a result, the choice of criteria to be used in selecting tasks to be trained is left to personal judgment.

2. Application - Selecting tasks for training is generally not preceded by a separate and distinct delineation of the tasks required by the job.

3. Application - Task selection for training is usually not done systematically. Its rationale is rarely explicit.

4. Application - Task priorities (that would provide the basis for getting the maximum training benefits from the available funding) are not specified.

Recommendations

1. Training developers should be required to make explicit the basis on which they select tasks for training, and to specify priorities among both the tasks selected and the tasks rejected for training for a particular job.

2. In the absence of information about the effects of task selection criteria on system performance, guidance should be developed on the types of task priority information likely to be relevant for different classes of jobs.

Analysis of Tasks

Findings

1. Methodology - Procedures for analyzing tasks are adequate.

2. Application - Job task conditions and standards, as distinct from *training* conditions and standards, are seldom identified. Course control documents do not require that job characteristics be specified.

Recommendation

1. Benefits of attempting to modify current practices do not appear great relative to costs. No change in present practice is recommended.

Construction of Job Performance Measures

Findings

1. Methodology - Procedures for developing JPMs are adequate in the ITRO model, unclear in the Marine Corps model, and not included in the AFP 50-58 model.
2. Application - JPMs have been developed in jobs where the consequences of inadequate performance are especially serious, such as in flight training or use of special weapons.
3. Application - In only one instance were JPMs developed as part of ISD to validate within-course tests.

Recommendation

1. While theoretically worthwhile, JPMs are costly to develop. It is unrealistic to recommend their development except in special instances. No change in present practice is recommended.

Selection of Setting

Findings

1. Methodology - A systematic procedure for determining the optimal setting for training does not exist. The development of such a procedure waits upon a means for measuring system performance, which in turn will permit the validation of site selection criteria and decision rules.
2. Application - In general, training developers do not have the authority to designate and develop training in different settings.

Recommendation

1. The choice of training setting has effects on the operational system beyond the training subsystem. It is appropriate that the setting selection be made at a higher level than training developer. In the absence of a means for assessing total system effectiveness, no change in present practice is recommended.

Development of Training Objectives and Objectives Hierarchies

Findings

1. Methodology - The ITRO model provides the most comprehensive, explicit, and straightforward procedures for translating job requirements into training objectives.

Deficiencies in the Marine Corps model could encourage writing objectives to match what is being taught, rather than to meet job requirements.

2. Application - The specification of training objectives is virtually universal, but the procedures used to identify objectives are highly variable and frequently unclear. There is evidence that objectives are often prepared after the fact and are derived from training content rather than used to generate it.
3. Application - Terminal objectives are seldom subjected to an explicit hierarchical analysis to derive intermediate objectives. A determination of the skills and knowledge that would enable the trainee to meet the terminal objectives would emerge from such an analysis; these often are not identified.
4. Application - Even where records are maintained, formats for displaying the relation between tasks and training objectives make it hard to determine what objectives have been derived from a given task. That is, tasks that represent objectives are displayed, rather than objectives that have been derived from each task. Thus, the justification for training for specific objectives is often not clear.

Recommendation

1. The derivation of training objectives from job tasks should be made explicit in a format that cross-references objectives *by task*.

Development of Achievement Tests

Findings

1. Methodology - All of the models require that achievement tests be developed from training objectives, rather than from the content of lessons, and all provide some information about test construction. All models lack procedures for maintaining congruence between the behaviors implied in an objective and the actual requirements imposed by test items (e.g., use performance tests to measure skilled behavior; require that concepts be applied when an objective implies their use rather than their recall or recognition).
2. Application - Many achievement tests are derived, not directly from training objectives, but from training content. Knowledge tests are particularly likely to be derived from content. In these cases, no independent criterion exists to determine whether training objectives have been met.
3. Application - In general, little or no consideration is given to matching the type and level of test items to the behavioral requirements of objectives (see Finding 1).

Recommendations

1. ISD models should explain and emphasize the purpose and need for deriving achievement tests from training objectives rather than from training content.
2. ISD models should be expanded to provide procedures for identifying and maintaining congruence between the behavioral requirements of objectives and test items.

Identification of Entry Behavior

Findings

1. Methodology - The major ISD models provide procedures for adjusting training objectives to match trainee capabilities.
2. Application - Estimates of capabilities of trainee populations are not verified by testing before the training is implemented.

Recommendation

1. The advantages of correcting inaccurate estimates of trainee capabilities do not appear to justify the costs of the measurement that would be required. Overestimates are likely to be identified during the validation of instruction, and underestimates usually become evident during the conduct of instruction. No change in present practice is recommended unless large investments in instructional materials are involved (e.g., Training Extension Course (TEC) development).

Classification of Objectives and Selection of Instructional Activities

Findings

1. Methodology - Procedures for classifying training objectives, and for selecting instructional activities accordingly, are not highly developed. Different models use different taxonomies for classifying objectives, and guidance for both classifying objectives and selecting instructional activities is provided largely by example rather than by means of explicit decision rules.
2. Application - Training objectives generally are not classified, and instructional activities generally are not specified.

Recommendation

1. Explicit decision rules for classifying objectives and selecting instructional activities should be developed. In the absence of such rules, no change in present practice is recommended.

Selection of Instructional Methods

Findings

1. Methodology - All models describe and discuss alternative instructional methods. They specify prerequisite conditions (e.g., setting, group size) for the use of particular methods but provide little information about the relative effectiveness of different methods, either for particular types of content or for trainee populations. Though perhaps sufficient to allow the training developer to reject inappropriate methods, the information base and the models themselves are not sufficient to provide for selecting optimal methods.

2. Application - Training methods are not systematically selected either on the basis of instructional activities (which are also not specified) or on the basis of trainee characteristics.

3. Application - Changes in training methods are almost always in response to command policy.

Recommendation

1. Present training technology is not advanced enough to support proceduralized derivation of training methods from previously specified instructional activities and trainee characteristics. Information about optimal training methods for different training situations, and procedures to enable developers to identify the most promising methods, should be developed. In the absence of such procedures, no change in present practice is recommended.

Selection of Media

Findings

1. Methodology - Procedures for selecting training media appear adequate to match the presentation (stimulus and response) requirements of instructional activities to appropriate media, if instructional activities have been specified in sufficient detail.

2. Application - Training media are not systematically selected on the basis of requirements of instructional activities (which are also not specified).

3. Application - Developers generally do not have freedom to select among alternative media. Choices and changes in media are usually directed by command policy.

Recommendation

1. Selection of appropriate media is contingent on how well instructional activities have been specified. No change in the current models for matching media to activities is appropriate until activities are more widely specified, and these models can be tested.

Grouping and Sequencing of Instruction

Findings

1. Methodology - Universal principles for grouping and sequencing instructional objectives do not exist, other than that dependent objectives be placed later than those on which they depend. Alternate theories and conflicting strategies abound, with no knowledge base for resolving them. Because systematically related principles for promoting learning are lacking, sequencing instruction must be left to the individual judgment of the training developers.

2. Application - Practices in grouping and sequencing instruction generally give no consideration to learning requirements other than the order imposed by obvious dependencies. Attention is given to constraints of non-learning factors such as equipment availability and scheduling.

Recommendation

1. Organized and systematically related principles of learning on which to base grouping and sequencing decisions are not available. The development of such information falls within the psychology of learning and is beyond the scope of recommendations in this report. In the absence of such information, no change in present practices is recommended.

Development of Plan for Authoring and Managing Instruction

Findings

1. Methodology - All models require the preparation of a plan for authoring and managing instruction.
2. Application - Plans that record course content are often prepared.
3. Application - Plans typically do not specify instructional events and are rarely used to develop instructional materials.

Recommendation

1. Explicit decision rules for selecting instructional activities do not presently exist (see Classification of Objectives and Selection of Instructional Activities above). Until such rules are available and generally acknowledged as valid, a requirement to specify instructional activities in an authoring and managing plan is likely to be viewed as a pointless exercise. No change in present practice is recommended.

Review and Selection of Existing Materials

Findings

1. Methodology - The ITRO and Marine Corps models state that decisions to use existing materials (rather than author new instruction) are to be based on the appropriateness of these materials to the previously specified characteristics of objectives, methods, and media. The AFP 50-58 model does not provide guidance for reviewing and selecting existing material.
2. Application - Characteristics to be identified in judging the appropriateness of existing training materials are not specified.
3. Application - Review and use of existing training materials is minimal, except for those in a course that is being revised.

Recommendation

1. The specification of necessary properties of materials for particular training situations, and the description and cataloging of existing materials to permit the interchange of matching components across courses, represent a degree of perfection

that is not presently attainable. An attempt to reduce the review and selection of existing materials to a systematic procedure is to act as if the methods of a well-developed technology were available in an area in which judgment is in fact the dominant factor. No change in present practice is recommended.

Authoring of Instruction

Findings

1. Methodology - All models specify that instructional materials undergo tryout during the authoring process. The ITRO and Marine Corps models emphasize that instruction should be lean to insure the economies of minimal instruction.
2. Application - There is little awareness of the concept of lean instruction, and few attempts to develop it.
3. Application - Instruction is rarely given tryout and revision during authoring.

Recommendation

1. Training managers should receive guidance on the purpose and importance of developing lean instruction. Guidance should indicate the role of tryout and revision of instruction as a necessary element of this strategy.

Validation of Instruction

Findings

1. Methodology - All models specify satisfactory procedures for validating instruction. The adequacy of training materials for attaining objectives is verified through the administration of achievement tests.
2. Application - Validation criteria—that is, evidence that instruction is satisfactory—are rarely specified.
3. Application - Instruction is rarely validated before it is implemented. When validation does occur, it is training materials (e.g., textbooks, tape/slide programs) that are evaluated; instructor lessons and lesson plans are almost never evaluated.

Recommendation

1. Of the three major types of ISD evaluation (validation, internal evaluation, external evaluation), validation has the greatest potential for effecting improvements in instruction. Once instructional materials have been produced and instruction has been implemented, changes are less likely to be introduced, and new materials are more difficult to generate. Validation trials to meet specified criteria should be required before new instruction is approved.

Internal Evaluation

Findings

1. Methodology - All models specify adequate procedures for the internal evaluation of training. Quality control of the training product is to be maintained through the administration of objective-referenced achievement tests.
2. Application - Evaluation and revision of instruction based on needs revealed in student performance (product evaluation) are generally not done.
3. Application - Training design decisions are rarely documented (process evaluation), to facilitate redesign when instruction is found to be inadequate.

Recommendation

1. Trainers should be required to determine and record trainee performance for each objective. Although absolute standards to identify when training revision is needed are difficult to establish, the recording of specific trainee performance would provide a desirable prerequisite to any revision. Moreover, it would suggest relative standards for the need to revise training.

External Evaluation

Findings

1. Methodology - the ITRO model prescribes the most reliable and most costly way to measure the adequacy of the instructional design process: administering Job Performance Measures to graduates in the field. It also provides the most guidance for isolating causes of performance discrepancies after the external evaluation of training. If summary evaluations are to be used, the ITRO and AFP 50-58 models specify that information be obtained at the task level of specificity, while the Marine Corps model does not.
2. Methodology - None of the models specify criteria that should be used to determine whether training is to be revised as a result of external evaluation, nor how to arrive at such criteria. None tell how good job performance must be to indicate that training is acceptable.
3. Application - The effectiveness of training is virtually never evaluated by the administration of Job Performance Measures to job incumbents.
4. Application - Supervisor summary evaluations of job incumbent performance are occasionally obtained but usually are not provided at a task or training objective level of specificity. Even when performance and job requirements information is obtained, it is rarely used to redesign training.

Recommendations

1. The high cost of administering performance tests to job incumbents and the difficulty of maintaining the necessary degree of objectivity and standardization preclude their widespread use to evaluate training. No change in present practice is recommended.
2. Training can be evaluated by gathering information (rather than direct measurement) about job performance and job requirements, at a task and training objective level of specificity, far more thoroughly than is presently done. The failure to obtain and use such information is a major shortcoming in current applications of ISD. While decision rules for using such information cannot at present be based on measures of total system effectiveness, other means for arriving at such criteria are available. It is recommended that *operational commands* define both the specificity of the task description and the level of performance they would be willing to use to evaluate the acceptability of job incumbents. These are the criteria that supervisors should use to judge (rate) field performance and establish the need for training revision.

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Instructional System Development (ISD) In the Armed Services: Methodology and Application

Chapter 1

INTRODUCTION

SYSTEMS ANALYSIS AND TRAINING DEVELOPMENT

Beginning in the late 1950s, systematic procedures began to be applied to the design of training programs in the military services. Early methodologies, influenced in general by operations analysis concepts of World War II and specifically by the recognition of a need for requirements analysis, emphasized empirical determination of the requirements of jobs and clear specification of the objectives of training.

During the 1960s and early 1970s, instructional design procedures became more codified. Models prescribing specific sequences of training development emerged. To the "front-end" analysis of earlier procedures, these later models added steps for the design and development of instructional content, as well as its implementation and control.[1]

Today the Army, Navy, Marine Corps, and Air Force all prescribe a similar sequence of procedures for the development of training. For example, all of the Services require that the design of training begin with an analysis of job requirements. All prescribe that these requirements be stated in terms of capabilities to perform specific tasks, that training objectives be derived from these tasks, that instructional content be selected solely to meet the objectives, and that instructional events be determined by characteristics of the content, capabilities of trainees, and level of mastery to be attained. None of the methodologies permit a rearrangement of the process so as to, for example, allow objectives to be determined by already existing instructional materials.

These procedures, though differing somewhat in organization and detail both across and within Services, are all models of essentially the same process and are currently referred to as Instructional System Development (ISD).[2] The process is characterized by a number of features common to systems analysis in general.

- *A system is comprised of subsystems and their interfaces.* In ISD, training is recognized as a subsystem of a larger operational system and interfaces with other subsystems (e.g., weapon system and job requirements, personnel classification and assignment policies). Training design decisions during the ISD process are made with a view toward optimizing the operation of both the total operational system and the training subsystem.

[1] Earlier versions of these procedures included: Design of Instructional Systems (DIS), Systems Approach to Training (SAT), Systems Engineering of Training (SET), and Training Situation Analysis (TSA). For a historical review of these methodologies and the development of the systems approach to training, see Montemerlo, Melvin D. and Tennyson, Michael E., *Instructional Systems Development: Conceptual Analysis & Comprehensive Bibliography*, Technical Report NAVTRAEQUIPCEN IH-257, Human Factors Laboratory, Naval Training Equipment Center, February 1976.

[2] The ISD models in use in the Armed Services are described in a variety of documents and manuals. Primary documents currently include Air Force Manual 50-2, *Instructional System Development* (1970); Air Force Pamphlet 50-58, *Handbook for Designers of Instructional Systems* (1973, 1974); Marine Corps Order P1510.23B (1978); *Interservice Procedures for Instructional Systems Development* (1975) (published by the Army as TRADOC Pamphlet 350-30 and by the Navy as NAVEDTRA 106A).

- *Subsystem objectives and configurations are based on an analysis of system requirements and subsystem relationships.* The ISD process begins with a detailed analysis of job requirements and a determination of which requirements are to be met through training. Decisions about the functions of the training are to be made on the basis of costs and effects to the operational system, costs to the training subsystem, and constraints of time, resources, and feasibility.
- *Systems analysis involves the empirical and iterative evaluation of alternatives.* The impact of alternative training configurations on the operational system often cannot be clearly anticipated. Also, principles for analyzing training requirements and decision rules for selecting and organizing instructional content to meet learning goals are not well developed. Training development requires a series of approximations involving test and modification.
- *Evaluation criteria are specified.* Within the training subsystem, instructional development is evaluated in terms of specific criteria that have previously been specified (i.e., behavioral objectives stated in terms of tasks, standards, and conditions) and the extent to which costs have been minimized in meeting these criteria (e.g., lean instruction). Evaluation of the adequacy of the ISD process itself (in contrast to the training it has generated) must be accomplished in terms of criteria external to the training subsystem. This poses a special problem in that criterion measures of the effectiveness of the operational system are generally not available.

While ISD interfaces with other components of the operational system, its focus is clearly upon the training subsystem. For example, although theoretically it would be possible, the process does not begin with complete freedom in conceptualizing the role of the human being in the operational system, that is, allocating functions to be performed by man and functions to be performed by hardware.[1] Rather, ISD begins with either the identification of a need to develop training for a new job or the recognition of a problem in existing training for an old job. In either case, *job requirements are largely fixed by the time ISD and the training developer enter the picture.* As we shall later see, the first ISD decision that has an impact on the operational system is one in which tasks are selected for training; that is, of all the tasks that must be performed by a human being, those for which training will be provided are specified.

The emergence and codification of the ISD process have overlapped with the appearance of a variety of techniques that are currently popular in contemporary training technology (e.g., criterion-referenced testing, individualization and self-pacing of instruction, audiovisual media, computer-assisted instruction, computer-managed instruction). As a consequence, there is sometimes a tendency for such techniques to be considered virtually synonymous with ISD. Such confusion works to the detriment of ISD. ISD, however, has its roots in systems analysis, and as such is primarily a *process* through which training alternatives are selected. It should not be identified solely with the application of specific training strategies or products.

[1] The *Interservice Procedures for ISD* (Executive Summary) explicitly states that ISD follows a specification of requirements of the weapon, force structure, strategy, and personnel subsystems. AF Manual 50-2 states that ISD " . . . identifies the nature and scope of the human role in the system . . ." but no further attention is given to the concept. AF Pamphlet 50-58, which provides detailed procedures for implementing the concepts of AF Manual 50-2, omits this phase.

SUMMARY MODEL OF ISD

A brief description of the components or steps of a generalized ISD model follows. It is based on an analysis of the major models now in use in the Services.[1] A later description discusses alternative placement of some of the steps.

Components of the model are necessarily depicted in a linear sequence. In practice, some of the steps may be conducted concurrently while others must be done sequentially. In keeping with a systems approach, all models emphasize the interrelationships of the steps. Adjustments are to be made during successive iterations of the process.

Need/Discrepancy Analysis

The first step in ISD consists of actions that either reveal or confirm a need to develop or revise training. If a need to revise training is identified, the point of entry into ISD and the boundaries of the redesign process are indicated.

Identification of Job Requirements

Job requirements are identified in what is clearly the keystone of the ISD process. This step consists of (a) developing a list of tasks encountered in the job, (b) verifying the list with a representative sample of job incumbents, and (c) gathering task priority information (e.g., frequency and difficulty of task performance).

Selection of Tasks for Training

Tasks for which training will be given are selected from those identified earlier during job analysis. Decisions are based on task priority information, training resources, and costs.

Analysis of Tasks

Conditions of performance, behavioral elements, and standards of performance within the job environment are described for tasks that have been selected for training. Task analysis provides information needed later for developing both Job Performance Measures and training objectives.

Construction of Job Performance Measures

Job-referenced tests of performance are constructed to serve as criteria for assessing the capabilities of trainees to meet job requirements.

[1] Several steps included in the Service models that do not directly affect the design process (Implement Instructional Plan, Conduct Instruction, Revise System) have been omitted from this generalized ISD model and from later discussion of the individual models.

Selection of Setting

The locus of instruction for tasks selected for training is identified. Decisions are based on such factors as cost, characteristics of instructional content, student load, and special constraints (e.g., range requirements). Decisions about on-the-job training options must consider their impact on the force structure.

Development of Training Objectives and Objectives Hierarchies

Most of the preceding steps have dealt with job requirements and job-related decisions. This step represents a shift in focus and constitutes the first analytic step in the development of instruction. Objectives are statements of performance requirements, conditions, and standards. Terminal objectives specify the overall behavior/outcome of task performance. Intermediate objectives specify the behavioral elements and the basic skills and knowledge that mediate terminal objectives. Intermediate objectives are identified by constructing objectives hierarchies, that is, multilevel displays of a successive breakdown of terminal objectives into their supporting behavior and mediating skill and knowledge.

Development of Achievement Tests

Achievement tests are referenced to instructional objectives. Their form depends on the nature of an objective; thus, paper-and-pencil tests are used to assess knowledge, performance tests are used to assess behavior, and so on. Where objectives are similar to job requirements, achievement tests may be similar or identical to the job performance measures developed earlier.

Identification of Entry Behavior

Instructional objectives developed earlier were based on estimates of student capabilities at the time of entry into training. These estimates are now verified to determine whether trainees possess these previously presumed capabilities. Objectives are modified to make them consistent with the capabilities of entering trainees. Entry behavior may also be assessed later, when actual instruction has begun, to determine whether capabilities of the entry population have changed over time, and to provide diagnostic information for placement purposes when instruction is individually prescribed.

Classification of Objectives and Selection of Instructional Activities

Objectives are classified as to type of knowledge and skill. Instructional events and conditions are selected in accordance with the characteristics of the capability to be acquired (e.g., intellectual skill, information, motor skill) and the level of learning required (e.g., familiarization, application).

Selection of Instructional Methods

Instructional methods are the means by which trainees are brought into contact with instruction. They are defined in terms of the size and location of the instructional group, degree of individualization, and type of instructional pacing, tutoring, and management. Methods are selected so as to maximize the effectiveness and efficiency of instruction, and selection depends upon the particular characteristics of the skills and knowledge to be acquired, the nature of the trainee population, the setting, and administrative requirements and constraints.

Selection of Media

Media are selected depending on the requirements of instructional activities and methods previously specified. Media selected must possess stimulus characteristics and response opportunities to support the instructional activities (e.g., texts to communicate verbal information, operational equipment or simulators to provide practice in tracking). Media must also be appropriate to the instructional methods (e.g., lecture or film for group instruction, sound/slide for self-paced instruction). From media that meet these requirements, final selection is made on the basis of such factors as cost, availability, production capabilities, size of trainee population, and training setting.

Grouping and Sequencing of Instruction

Topics are usually grouped on the basis of commonality of subject matter and anticipated transfer of learning. Dependent relationships among training objectives primarily determine the sequence of instruction. Independent and coordinate objectives are sequenced in accordance with such principles as simple to complex, familiar to unfamiliar and job order.

Development of Plan for Authoring and Managing Instruction

A written plan(s) is prepared to transmit the decisions and specifications determined in previous ISD steps to those who will author, conduct, and manage the instructional program. The plan includes (a) guidelines and supporting information for the preparation of lesson content (e.g., how stimulus material is to be presented and performance elicited, types and schedule of testing, trainee literacy characteristics), (b) description of student management procedures and instructor roles, and (c) administrative information (e.g., class size, equipment use, and facility schedules).

Review and Selection of Existing Materials

Before new instructional materials are produced, existing materials are examined to determine whether they can be used or adapted for use. In order to be adopted, existing materials must conform to prior specifications for instructional activities, methods, and media.

Authoring of Instruction

New instruction, intentionally lean in nature, is developed in accordance with prior specifications. As first drafts are prepared, small portions are tried out on persons representative of the entry population, and are modified and augmented as needed.

Validation of Instruction

In validation, newly developed instruction is evaluated prior to implementation, under conditions that closely approximate its intended use. Lessons or an entire course is administered to small groups of trainees; objective-referenced achievement tests are given to determine the effectiveness of instruction; and training is modified as necessary to meet standards.

Internal Evaluation

Internal evaluation consists of continuing assessment of the effectiveness of instruction when it has been implemented. The principal measure of effectiveness is the trainees' performance on objective-referenced achievement tests (product evaluation). To aid in identifying any deficiencies that may be revealed, internal evaluation includes analysis of how the ISD process was actually carried out (process evaluation).

External Evaluation

External evaluation occurs when graduates of a training program have reached the job. Whereas internal evaluation determines whether trainees are attaining course objectives, external evaluation uses an external standard, job performance, to evaluate proficiency and the adequacy of the instructional process. Information is usually obtained by administering questionnaires to graduates and their supervisors; occasionally it is obtained through testing or observation of performance.

ORIGIN AND PURPOSE OF THE STUDY

ISD models and their forerunners have been in use for approximately ten years[1] — a long enough period so that a study of how adequate they are, and how they are being used, can be undertaken. In late 1977, the Office of Assistant Secretary of Defense (MRA&L) requested HumRRO to undertake such a study. The objectives were to gather information about the effectiveness of the various ISD methodologies and to determine how they were being applied in each of the Services. What problems had arisen in their application? How might the procedures be made more effective?

[1] Montemerlo and Tennyson, *loc cit.*, indicate: "The Navy first entered this field with the development of the Training Situation Analysis (TSA) methodology (Bertin, 1963; VanAlbert, *et al.*, 1964; Chenzoff & Folley, 1965). The Army began with Project Minerva, an Army Security Agency study which resulted in the *Design of Instructional Systems* (DIS) manual in 1966 . . . Two other influential manuals of this period were Butler's (1967) *Instructional Systems Development* (ISD) manual, which was written under Job Corps auspices, and Rundquist's course design manual (1966, 1967, 1970) which was developed at the Navy Personnel Research and Development Center."

While a systems approach to training has many potential advantages, it is difficult, time consuming, and costly to carry out. It will be worth the cost and effort only to the extent that it is being implemented so as to realize its potential. For example, considerable data and information from a variety of sources both within and without the training subsystem must be developed and analyzed. Interdependencies in the development process make coordination necessary among training developers concerned with different phases. In each phase there must be accomodation to information and products developed in prior phases. The requirement for continuous verification and revision, while a major strength of the systems approach, is particularly demanding. To achieve the system's goals, instructional systems developers must be able to maintain sustained commitment to a repetitive and often difficult process.

At least one earlier study revealed many problems when there was an attempt to institutionalize a systems approach to training development. Ricketson, *et al.*, interviewed personnel who were attempting to implement USCONARC Regulation 350-100-1, *Systems Engineering of Training - Course Design*, at the U.S. Army Aviation School.[1] Even though the procedures in the CONARC Regulation were far less demanding than those called for in current ISD models, significant problems were encountered with their interpretation and application. Guidance was found to be incomplete, contradictory, and lacking in detail; individual steps in the process were difficult to relate to one another; job analysis data collected in the field omitted important tasks and described others in excessive detail; product review was slow and contributed to wasteful false starts; personnel turnover was disruptive; and so forth.

The magnitude of the requirements make it reasonable to ask how ISD is currently working in actual practice. Are the methodologies adequate? Are they being complied with? Do they make a difference?

SCOPE OF THE STUDY

As has been indicated, the absence of a criterion of system effectiveness precludes evaluating the effects of ISD on the basis of total system performance. Instead, the study focuses on the training subsystem and within this subsystem is restricted to an analysis of methodology, process, and intermediate products. The job performance of course graduates has not been examined.

The analysis of ISD in this study is based upon information developed in three major activities:

- Analysis of the primary documents currently in use in the Army, Navy, Marine Corps, and Air Force for guidance in conducting ISD.
- Questionnaire survey of 209 units, agencies, and schools where instruction is developed in the Services.
- Detailed interview of training developers from 33 of the organizations surveyed to determine how 57 specimen courses were designed.

Chapter 2 of the report contains an analysis of the ISD process and of the major ISD models being used in the Services. Chapter 3 describes the questionnaire survey undertaken to select a sample of ISD applications for detailed analysis. Chapter 4 describes the role and structure of organizations performing ISD in each of the Services. Chapter 5 describes how the models are being applied as revealed in the interviews with developers of training. Chapter 6 summarizes the findings of the study and makes recommendations.

[1] Ricketson, Darwin S., Schulz, Russel E., and Wright, Robert H. *Review of the CONARC Systems Engineering of Training Program and Its Implementation at the US Army Aviation School,* Consulting Report, HumRRO, April 1970.

Chapter 2

ANALYSIS OF ISD PROCESS AND MAJOR ISD MODELS

INTRODUCTION

It is appropriate to begin an analysis of Instructional System Development activities in the Armed Services with an examination both of the process itself and of the models and manuals that are intended as procedural guides to the process. The issue of whether ISD can or cannot be reduced to procedures to be applied by nonprofessional practitioners has been discussed elsewhere.[1] Continuing the debate is not likely to be fruitful. In any event the majority of persons who are currently attempting to apply ISD in the Armed Services have acquired their understanding of the process primarily from descriptive manuals or from instruction derived from the manuals. It cannot be expected that ISD applications will be any better than the guidance they are based upon.

Primarily ISD guidance documents[2] currently in use in the Services are:

- *Interservice Procedures for Instructional Systems Development* (1975), published by the Army as TRADOC Pamphlet 350-30, and by the Navy as NAVEDTRA 106A—Developed for the Army and later approved by the Interservice Committee on Instructional Systems Development. Contains detailed procedures for conducting ISD. Hereinafter referred to as the ITRO model.
- Marine Corps Order P1510.23B (1978)—A greatly reduced version of the ITRO model incorporating documentation requirements specific to the Marine Corps.
- Air Force Manual 50-2, *Instructional Systems Development* (1970, 1975)—An overview of the ISD process.
- Air Force Pamphlet 50-58, *Handbook for Designers of Instructional Systems* (1973, 1974)—Detailed procedures for implementing the concepts in AF Manual 50-2.

[1] Montemerlo and Tennyson, *op. cit.*, pp. 10-12.

[2] In addition to these primary documents, various modifications and supplementary documents are in use. For example, the U.S. Army Armor School has published the *Training Development Handbook* (1977), which is largely a revision of the ITRO model that also incorporates terminology and documentation requirements specific to the Army; the Chief of Naval Technical Training has published CNTT-A10 *Procedures for the Planning, Design, Development, and Management of Navy Technical Training Courses* (1976), specifying procedures and documentation formats to be used in conjunction with the ITRO model; the U.S. Naval Health Sciences and Education Command has published the *HSETC Handbook for Implementation* (1977), intended to provide supplementary guidance for use of the ITRO model within the command; the Chief of Naval Education and Training has published NAVEDTRA 106A Supplement No. 2, *Instructional Program Development, Training Task Analysis Procedures* (1978) and NAVEDTRA 110, *Procedures for Instructional Systems Development* (1978), providing Navy-specific guidance for implementing the ITRO model; the Naval Training Equipment Center has sponsored development of Military Specification MIL-T-29053, *Training Requirements for Aviation Weapon Systems* (1977), to guide ISD efforts by civilian contractors. These are only examples of the various supporting documents that have been published.

With the exception of Marine Corps Order P1510.23B, these documents generally are available in each of the Services. One should not assume, for example, that the ITRO model is used exclusively in the Army and Navy or that Air Force documents are never referred to outside the Air Force.

The remainder of this chapter contains the step-by-step analysis of the ISD process and evaluation of the three major manuals/models: the ITRO model, Marine Corps Order P1510.23B, and AF Pamphlet 50-58. The steps and requirements of a generalized ISD model have been derived in part from synthesizing the Service models and in part through rational analysis of their intended functions. Several steps included in the Service models that do not directly affect the design process (Implement Instructional Plan, Conduct Instruction, Revise System) have been omitted from the generalized ISD model.

Each of the following sections contains a description of a specific ISD step; a summary of prerequisite conditions and information, and procedural requirements for performing the step; an analysis of the instructions provided in each of the three Service models for meeting the requirements; and a summary commentary.

STEPS OF PROCESS AND MODELS

Need/Discrepancy Analysis

ISD originates with the identification of a need to develop or revise instruction. Instruction will have to be developed if human performance in a new job or weapon system needs to be trained; instruction will have to be revised if existing training is not sufficiently effective and economical. Some models explicitly identify an analysis of needs as part of ISD, while others describe it as an antecedent condition. Whether this step is viewed as lying within or without the process is largely a matter of definition. It is important, however, that ISD follow a determination of need rather than be undertaken on *a priori* grounds. The process itself is costly and should be justified.

Prerequisite conditions for determining need are the existence and maintenance of procedures for detecting indications of potential discrepancies. In an ideal world, discrepancies in training would be identified by constantly monitoring (a) job requirements (does job analysis indicate that job demands are not adequately reflected in training or that they have changed since an earlier determination?), (b) job performance (does measurement of job performance indicate that job incumbents are not adequately trained?), and (c) course materials (does empirical comparison of alternate types of content and media indicate that training is not maximally cost effective?). These ways of identifying discrepancies are, of course, extremely costly. In the real world, these methods must be used selectively, so there should be a means to determine when their employment is appropriate. Continuous job analysis, performance testing, and empirical comparisons of alternate forms of training are neither feasible nor desirable.

Indications of changing job requirements and inadequate training may be as diverse as high accident rates, reports of inadequate performance from supervisors and field commanders, and discrepancies between course syllabi and duties reported in occupational surveys. Symptoms that training may not be effective and efficient are to be seen in such indicators as high course attrition rates, unusual course length and cost, or negative comments from students and instructors.

When a potential discrepancy is identified, additional information is gathered as needed to confirm and define the problem and to suggest the appropriate locus for corrective action, that is, where the ISD process should be entered for remediation. If, for example,

there is an apparent discrepancy between job requirements and the performance of job incumbents, existing training will be examined to determine whether the problem lies in an original analysis of the job, whether errors have occurred in the translation of job requirements into objectives of training, whether the way in which training is actually conducted is ineffective, and so on. The extent of ISD that subsequently will be undertaken depends both upon the origin of the problem and upon its specific characteristics. If analysis of the problem reveals a need to add a few new objectives requiring training similar to that already given, it is not likely that the entire ISD process will be necessary.

Summary of Requirements

Prerequisite Conditions and Information

1. Information is available about possible discrepancies between training and field requirements.

Procedures

1. Analyze initial and supplementary information.
2. Identify and specify discrepancy.
3. Specify ISD entry point and boundaries of redesign process.

Analysis of Service Models

ITRO Model. The Executive Summary presents a diagram to show that ISD is preceded by an analysis of weapons systems, the force structure, manpower, and existing strategies. This analysis, the diagram indicates, leads to the identification of any "performance discrepancy" between requirements on the one hand, and existing programs on the other. If no discrepancy exists, of course, nothing need be done. If there is a discrepancy, ISD will provide "alternative solutions for selected defined performance discrepancies." The text of the Executive Summary indicates that discrepancies arise from such happenings as changes in technology or force structure. It suggests an equivalence between this type of analysis and the Phase I activities of the ITRO model (job analysis, selection of setting), but does not make this explicit.

In Step 1.1 (Analyze Job), the ITRO model states that the first step of ISD is to identify the discrepancy between existing and required training, and that the first requirement in this process is an adequate job analysis. If no job analysis has previously been accomplished, the model specifies that the ISD process should be undertaken from the beginning. However, if a training program already exists that is based on an adequate analysis, and if tasks had been selected and Job Performance Measures constructed in accordance with ITRO procedures, the model does not specify further how to identify the discrepancy.

Marine Corps Order P1510.23B. The Marine Corps model begins with job analysis, and does not explicitly identify a need/discrepancy analysis as part of ISD.

Air Force Pamphlet 50-58. The AFP 50-58 model does not contain procedures for a need or discrepancy analysis, but does refer to the Air Force Manual 50-2 ISD model. In that model, "Analyze System Requirements" is the first of five steps. This includes an analysis focusing on the human role in the total operational system, eventually reaching the level of specific job requirements. The ISD procedures outlined in AFP 50-58, then, would presumedly be initiated when such a prior analysis indicated a need to develop or revise training.

Commentary. None of the models provides specific guidance for identifying discrepancies, other than between the need for training and the lack of a training program. Although the ITRO model states that procedures will be given to assist the developer in "determining the exact location of the discrepancy in the training program," the only procedure actually given for existing training programs is to undertake ISD, and the only point recommended for entering the ISD process is at the beginning. No provision is made for any alternative means of identifying and resolving performance discrepancies.

Identification of Job Requirements

No decisions about training can be made until an accurate picture of the requirements of the job is obtained. Job analysis and task analysis, therefore, are first steps in developing training. Job analysis determines what tasks are performed on the job and provides information that can be used to establish instructional priorities. Task analysis investigates the conditions, operations, and standards that define job performance. Because job analysis and task analysis involve different activities, they are ordinarily performed as separate steps of ISD. Task analysis generally requires a lengthy and detailed specification of the task's behavioral elements. It is probably not efficient to undertake it before eliminating some tasks in the step, Selection of Tasks for Training.[1]

Job analysis consists of three parts: compiling a provisional list of tasks believed to comprise the job, verifying the accuracy of the list and adjusting it as necessary, and gathering task priority information. Task lists are developed in two phases to increase their reliability. Since ISD is a process for developing training, it is reasonable to expect that trainers will be responsible for the analysis, but their familiarity with field requirements can vary widely. A verification phase permits the provisional task inventory to be administered to a larger sample of operational personnel for validation.

The initial task list can be generated in various ways, ranging from recall by a single subject matter expert to extensive observation of job incumbents. The accuracy of the final job description is likely to be influenced by the comprehensiveness of the initial inventory. Though the verification phase allows tasks to be added to the list, there is no guarantee that respondents will do so.

Verification may also take different forms ranging from the use of a second group of subject matter experts who are convened to review the original task list, to a phone or much broader mail survey. In concept, verification should provide for validation with a representative sample of job incumbents. Depending on the job, this usually implies a larger and more varied sample than is provided in a second group of subject matter experts.

Task priority information is data about such factors as billets where the task is performed, percent of persons performing, frequency of performance, difficulty in learning and performing, probability of deficient performance, consequences of deficient performance, and average time between training and performance. These inevitably are subjective estimates. To increase their reliability, this information should usually be gathered from a fairly large sample of job incumbents. Where task lists are being verified by mail or some other form of large-scale survey, task priority information may be gathered at the same time. In this case, however, a second survey will be needed to obtain information about tasks added to the list during verification.

[1] See Analysis of Tasks, p. 17, for a discussion of the location of this step in the ISD process.

Summary of Requirements

Prerequisite Conditions and Information

None

Procedures

1. Construct provisional task list.
2. Verify and revise on basis of review/survey of job incumbents.
3. Collect task priority information.

Analysis of Service Models

ITRO Model. On-site interviews (which can include observation) are recommended for constructing the initial task list. Methods mentioned as less effective include the questionnaire survey, jury of experts, and group interview. For verifying the accuracy of the task list, the ITRO model specifies the questionnaire survey method. When a current, complete task list already exists, the initial data-gathering phase is omitted, and only the verification phase occurs.

For collecting task priority information, the model recommends sending a questionnaire to incumbents and supervisors, either at the same time as task list validation, or in the next ISD step.

Marine Corps Order P1510.23B. Several methods are listed for collecting job data, such as interviews, observation, analyzing the content of training programs, or assumptions. The manual states that each method has advantages and disadvantages relative to the others, but does not tell what these are, nor recommend any method over another. (A single exception is the statement that "detailed personal interview" is superior to "assumption analysis." This is presented as an example of why a record should be retained of what methodology was employed.) To verify the accuracy of the task list, the Marine Corps model specifies that it be "double checked" by a group of subject matter specialists, including supervisory and instructor personnel. The use of questionnaires to collect task priority data is not discussed; the only suggested source of this information is Commandant of the Marine Corps task analyses.

Air Force Pamphlet 50-58. The AFP 50-58 model recommends obtaining a verified task list from an Occupational Survey, if available. If not, the model recommends using a team of seven or eight subject matter experts to develop the list, based on such factors as specialty descriptions, familiarity with similar jobs, and engineering data. Although implying that this method is not as desirable as an "in-depth survey," AFP 50-58 notes that the time and resources required for the latter are seldom available to training developers. Interview, observation, and questionnaire are also mentioned as possible data collection methods. To verify the task list, suggested methods include questionnaire, interview, observation, simulation, and assumption. For collecting task priority information, the model suggests the use of Occupational Survey Reports, interviews with subject matter experts, and questionnaires.

Commentary. While the ITRO and AFP 50-58 models recommend surveys for collecting data about job tasks, both acknowledge that less reliable and less costly methods may have to be used. The Marine Corps model, with the exception noted, does not identify any one method as superior for compiling and verifying task lists, and contains almost no guidance for collecting task priority information. All the models, then, allow much latitude in choice of methods. Under these conditions, the accuracy of the task list and the reliability of task priority data would appear to depend on the experience and conscientiousness of the persons collecting and contributing information. rather than on the particular model followed.

Selection of Tasks for Training

Tasks identified during job analysis are classified on the basis of whether training will or will not be provided. Those selected will become the basis of the training program, those rejected will not be reconsidered until the external evaluation. This step is based on the premises that (a) for some tasks identified by job analysis, it is not necessary to provide training, and (b) resources may not be sufficient to provide training for all tasks on which training would be desirable.

Prerequisites to the selection process are a list of tasks that comprise the job, information about the tasks for establishing their importance and need for training, and decision rules for determining training priorities. To promote objectivity, the information, and the procedures for processing it, should be developed prior to the selection process. In the absence of a parent list of tasks, selection is not selection at all, but simply a decision. If task lists, priority information, and rules of application are developed conjointly with task selection, inevitably the latter will influence the former. It will be difficult to avoid establishing priority criteria consonant with one's viewpoint on what is important to train; that is, one easily acquires a tendency to select criteria to fit tasks rather than selecting tasks on the basis of criteria. This is especially likely because the choice of criteria itself is largely based on judgment; information about the relation of task selection criteria to total system performance is not available. At present, there is no way to test the adequacy of tasks selected in terms of overall system effectiveness.

Some task characteristics that are used to determine training priorities are number and percent of persons performing, frequency of performance, learning difficulty, time spent in performance, learning decay rate, length of time after training before performance, and criticality (probable consequences of inadequate performance). Characteristics such as frequency of performance can be determined empirically; others, such as criticality, by consensus.

After identifying which tasks are desirable to train, and which of these are most important, the requirements for training resources are considered. The final selection of tasks to be trained is made on the basis of training resource requirements and availability—that is, cost. Some factors which affect the number of tasks for which training can be provided are the number of graduates required and the demands training will make on time, facilities, equipment, fuel, and instructional personnel. If not all desirable tasks can be trained, less important tasks are rejected.

A factor that greatly influences the demands made on training resources is the training setting (i.e., resident instruction, formal on-the-job training, self-taught packages, etc.), although to avoid possible bias in task selection, the setting is selected in a separate ISD step. If the setting is identified before the tasks are selected, there may be a tendency to select tasks that are easy or economical to train in that setting and to avoid those that are difficult and/or expensive. Also there may be a tendency to select tasks that have been taught in the prescribed setting before.

Although the desirability of isolating task selection from setting selection is clear, there is a contradiction inherent in separating the two. Tasks are ranked in importance on the basis of their characteristics but selected for training on the basis of available resources/cost, and cost is, in turn, greatly conditioned by setting. To completely separate these processes would be to defer consideration of perhaps the greatest cost factor until after tasks have been selected, when this selection is ultimately constrained by cost. To maintain, insofar as possible, the advantages of separation, and yet avoid this error, the selection of tasks and setting must be accomplished in a series of interactive iterations.

Summary of Requirements

Prerequisite Conditions and Information.

1. Tasks performed in the job are listed.
2. Information is available for establishing importance of tasks and need for training.
3. Decision rules to be applied to task information are available.

Procedures

1. Apply decision rules to information for each task to determine training priorities.
2. Select tasks for training on basis of training priorities and resource availability.

Analysis of Service Models

ITRO Model. The first step of the ITRO procedure is to define the criteria by which task importance will be measured. Percent performing, time between job entry and task performance, and learning difficulty are suggested as the most appropriate criteria for determining the absolute importance of tasks, and criticality (consequences of inadequate performance) as more applicable to combat tasks than noncombat. It is further suggested that the number of criteria selected be generally limited to about four. Beyond such suggestions, no guidance is given for selecting criteria.

When the criteria have been decided upon, questionnaires are constructed, then used to collect the task priority information from incumbents and supervisors. (This may be done simultaneously with job analysis, in the preceding step.) The data gathered are then examined to identify tasks that do not warrant training. This is a rather gross determination, designed to weed out tasks that are obviously not important. The model states that if there is doubt about a task's importance, it should probably be retained at this point.

Next, available training resources are estimated, as an aid in determining about how many of the remaining tasks can be trained. Then the tasks in which training is needed the most are selected, up to the tentative number to be trained; another 20% or so of tasks next in importance are also identified, and rank-ordered, to be available for selection when resource availability is known precisely. The model states that tasks which rank lower on the task selection criteria are less in need of training, but does not suggest methods for weighing the relative importance of the several criteria, nor for considering how the different criteria might be related to total system effectiveness.

Marine Corps Order P1510.23B. The Marine Corps model provides guidance similar to that of the ITRO, but more briefly stated. It presents eight task selection criteria but does not differentiate among them as to applicability. As noted earlier, no procedures are described for collecting task priority inforamtion, other than obtaining a task analysis report, if available.

Air Force Pamphlet 50-58. Three criteria are specified for use in selecting tasks; number performing, percent performing, and criticality. The model also provides rules for applying the criteria (e.g., if the number performing a task were 51-100, and the percent performing below 50%, the task would be recommended for training if its correct performance would increase job effectiveness, but not if its correct performance would merely increase efficiency). AFP 50-58 stresses that the rules for applying the criteria are only guidelines to making an "initial decision" about task selection, which must be verified by some other means. No guidance is provided regarding any conflict between training requirements and availability of training resources.

Commentary. All the models, then, suggest criteria by which to select tasks for training, but only one provides a formula for their application—and that only conditionally, and for only three criteria. Moreover, the Marine Corps model's lack of guidance for collecting task priority information could result in the practice of exploring priorities simultaneously with selecting tasks, thereby neutralizing the advantages of collecting priority information in a separate step.

To specify more fully how to select and weigh various criteria, information is clearly needed concerning how the criteria are related to job performance. It is not known, for example, how total system effectiveness is changed as a result of selecting difficult tasks, in contrast to tasks with high percentages of total time spent performing, or *vice versa*. Indeed, for almost every criterion suggested a rationale can be found for using it to reject tasks instead of selecting them. For example, it can be argued that training should be given for more frequently performed tasks because this will insure that the effects of training will be more widely felt. On the other hand, it is not too extreme to suggest that training not be given for the most frequently performed tasks on the premise that incumbents will have a better opportunity to learn them on the job. In the absence of information about how system effectiveness is related to task selection criteria, rational analysis alone cannot be used to select the criteria.

Analysis of Tasks

In the context of ISD, task analysis is a description of when and how within the job environment the performance of a task is required. Thus it consists of specifying conditions of performance along with initiating cues, behavioral elements, and standards of performance. The information generated is later used in constructing Job Performance Measures and in developing objectives.

The only prerequisite for task analysis is that tasks to be analyzed have been identified. It therefore can be undertaken almost concurrently with, and is considered by some a part of, job analysis. Job analysis, however, consists essentially of a rational reconstruction of job requirements followed by a survey of job incumbents. Task analysis, on the other hand, requires a detailed specification of the elements of task performance. Because different activities are involved in the two functions and because task analysis is often a lengthy and costly process, it should usually be undertaken only for those tasks that have previously been selected for training.

Though it is generally more efficient to do task analysis after task selection, this order of events can be a source of problems. The longer that task analysis is delayed, the greater the possibility that it may become confounded with decisions about training. When tasks have already been selected for training, for example, there may be a greater tendency to describe them as they will be performed in training rather than as they are performed on the job. It is important to emphasize that while *training* conditions and standards (established later in the ISD process) may differ considerably from those of the *job*, it is not the purpose of task analysis to determine how a task will be trained. Rather it is to discover under what conditions the task is actually performed, and what standards of performance are required in the *job*. Also, when selecting a task for training means that it must be analyzed and rejecting it means that no analysis will be required, there can be a tendency to select tasks that have few behavioral elements, or on which the standards are easy to identify, and so forth. (A parallel is the visible tendency within the field of education and training to teach those things that are easiest to explain.)

Summary of Requirements

Prerequisite Conditions and Information

1. Tasks have been selected for training.

Procedures

1. For each task specify for the job environment:
   - Conditions of performance.
   - Behavioral elements.
   - Standards of performance.

Analysis of Service Models

ITRO Model. Task analysis is included in the step "Analyze Job," which specifies that the conditions, initiating cues, standards, and elements of each task be listed. The manual provides a Job Data Worksheet that can be used for this purpose. The information is to be collected in the same manner and from the same sources as data for the task inventory. This can be done at the time of the original inventory, for all tasks, or later for only those tasks selected for training.

Marine Corps Order P1510.23B. The model specifies that task elements be identified along with tasks when job analysis is conducted. A recommended hierarchical format, the Job Analysis Sheet, is illustrated. However, standards, conditions, and initiating cues are not recorded on this Job Analysis Sheet, but are "preserved to be used during step I.3, Construct Job Performance Requirements and Measures." During step I.3, they are written down on a different form, the Consolidated Job Data Sheet, along with some other information concerning the task.

Air Force Pamphlet 50-58. The model specifies that tasks be divided into "subtasks" as part of job analysis, but no other task analysis is done until tasks are selected for training. Subtasks are identified to create task units nearly equal in complexity and amount of implied activity, for ease of analysis later. After tasks are selected, elements ("actions"), cues, standards ("proficiency requirements"), time required, and other aspects of the task, such as precautions to observe, are recorded in any one of four general formats shown in the manual.

The AFP 50-58 model does not discuss task conditions *per se*. In the illustration of the use of a recommended format for task description, however, two of the items are similar to conditions. Under the heading "Activity Support Elements" for a task involving the use of a calculator, are listed the calculator, operator's manual, list of values, etc. Under the heading "Support Information" are listed such items as "Assume values are dollars . . ." and "Assume prior orientation to calculator."[1] In this latter case, however, it appears that the description of the task as performed on the job is beginning to be confounded with a description of the conditions under which it will be trained.

Commentary. The procedures suggested in the three models do not differ markedly. The use of any model could be expected to result in an adequate definition of the task.

Construction of Job Performance Measures

After tasks have been selected for training, a test may be constructed for each task to serve as a means of keeping training faithful to job requirements, as a means of

[1] AFP 50-58, Vol. II, p. 2-51, Fig. 2-38.

evaluating training and the design process, or both. To serve either purpose, the test, or Job Performance Measure, should possess high predictive validity; that is, performance on the test should be highly related to performance of the task itself.[1] If the test is to serve as a means for keeping training faithful to job requirements, the behaviors, conditions, and standards of the Job Performance Measure must resemble those of the actual task as closely as is practical. If the test is to be used to evaluate training, it can conceivably vary in fidelity as long as its predictive validity is maintained.

To evaluate training design, Job Performance Measures are administered to persons in training, or to persons after they have reached the job. Although the latter method may give a more accurate measure, it is also more costly. If trainees, or graduates, pass the Job Performance Measure, the training is considered successful. If not, the training cannot be considered adequate, regardless of trainees' previous performance on within-course achievement tests.

In attempting to keep training requirements faithful to job requirements, the Job Performance Measures serve as a connecting link between the tasks and the objectives of training. In later ISD steps, the tasks identified by job analysis, and selected for training, must be translated into training objectives and tests of those objectives. Some degradation in fidelity can be expected at that point: job conditions cannot always be reproduced in training; standards may need to be lowered for training; perhaps only part of a task will be judged to require training. In this translation from job requirements to training requirements, there will be much opportunity for error. In the name of adjusting to training conditions or constraints, critical aspects of task performance for which training was seen as necessary can virtually disappear. Job Performance Measures can serve as standards for preventing such extreme degradation.

After the measures have been constructed and validated, objectives can be derived directly from them, and achievement tests for the course can be derived in turn directly from the objectives. Since the Job Performance Measures have already been determined to be good predictors of task performance, then objectives and tests which resemble the Job Performance Measures closely can be expected to lead to successful task performance. Although the capacity of the Job Performance Measures to help achieve this end is subject to how well they are adhered to, generally the existence of such a model can be expected to inhibit departures from job requirements.

To serve their purposes, Job Performance Measures must be constructed before objectives or tests are developed. To provide an independent assessment of, or point of reference for, training, they must be independent of training. If they were not constructed until after training objectives had been formulated, it would be nearly inevitable that they would reflect training to some degree. To whatever extent *training* behavior, standards, and conditions are incorporated in the Job Performance Measures, they are that much less capable of measuring the job adequacy of the training product.

[1] In traditional test construction, criterion-based validity has been viewed as the most desirable kind of validity to demonstrate. Here criterion-related validity would be a statistical demonstration of the relationship between the test and the ultimate criterion, actual performance of the task on the job. Where, however, the test under consideration *is* a performance test that is content valid, there is usually no better criterion of task performance available. In the absence of another criterion of known high validity, it is meaningless to pursue the issue of criterion-related validity. In such situations, another variety of predictive validity—so-called concurrent validity—can be sought, that is, the capacity of the test to distinguish performers who are acknowledged to be effective or highly experienced from those who are seen as ineffective or who are novices.

Not all models of ISD include the construction of Job Performance Measures. The alternative to deriving objectives and tests from Job Performance Measures is to derive them directly from descriptions of tasks, and this is what some models prescribe. It is difficult to foresee exactly how training development is affected by doing without a model or means of evaluation. Certainly the relation between training and job performance may, in some cases at least, be so obvious that the construction of a Job Performance Measure would seem superfluous. Considerable effort is involved in the construction of these measures, which may not be justified. Nevertheless, a ready means for determining whether training is meeting its goals would appear to be virtually indispensable to a systematic approach to training design and development.

Summary of Requirements

Prerequisite Conditions

1. Tasks selected for training are listed.
2. Training requirements for these tasks have not been identified.

Procedures

1. Construct a test for measuring the performance of each task selected for training.
2. Validate each Job Performance Measure to insure that it predicts task performance.

Analysis of Service Models

ITRO Model. A Job Performance Measure is to be constructed for each task selected for training. The model discusses predictive validity, and states that it cannot be determined if there is no way to test the task under actual job conditions. In such cases, the model states, the physical fidelity of the Job Performance Measure will be used as the criterion of its adequacy. The process of measuring the physical fidelity of the Job Performance Measure is termed "verification." However, although the model distinguishes between validation and verification at some points, it confounds them at others, and it does not adequately explain how validation or verification is to be accomplished. For example, it does not make explicit that, in the validation process, task performance is used as the validation criterion, while, in the verification process, the physical fidelity of the test itself is judged, not task performance.

Marine Corps Order P1510.23B. The Marine Corps model states that Job Performance Measures must be constructed and validated. It specifies that the validity of the tests should be higher for tasks in which inadequate performance has more serious consequences.

Air Force Pamphlet 50-58. This step is not included in ISD, nor is any equivalent step. In a later step, objectives will be derived directly from tasks and task elements.

Commentary. Despite some lack of clarity, the ITRO model's explanation of how to construct and validate Job Performance Measures would appear sufficient to enable a test designer to produce them. The Marine Corps model, which severely abbreviates the ITRO explanation, and combines Job Performance Measure construction with certain task analysis activities ("Construct Performance Requirements") in a single step, would not appear altogether adequate. Perhaps significantly, the Marine Corps model does not specify later that objectives be derived from the Job Performance Measures, but rather from the Job Performance Requirements, which are essentially records of task analysis. The role of the Job Performance Measure in the Marine Corps model is thus

somewhat unclear. As noted, the AFP 50-58 model objectives are also derived directly from task analysis information. In this respect, the AFP 50-58 model is consistent when it omits the construction of Job Performance Measures. At the same time, this omits from the model a significant means of measuring the validity of instructional programs.

Selection of Setting

A tenet of ISD is that training should be provided in the most cost-effective setting. Every task previously selected for training must now be assigned to a particular location and situation in which training will occur. Training may be conducted in one or in a combination of situations: at resident schools and training centers, at installation support schools, and through a variety of formal on-the-job procedures. The latter category includes the use of such techniques as self-teaching lessons and job aids (proceduralized manuals and performance guides).

An obvious prerequisite to carrying out this step is the freedom to assign tasks to any of several settings. Without a range of options, there can be no true selection. When only one setting is available, there is the danger of having to assign an excessive number of tasks inappropriate to the setting or to forego training for those tasks altogether. It follows that a variety of settings must be available and that, within each military service, the selection of setting(s) must be made at an organizational level which has the authority to implement its decision.

Another prerequisite is the availability of information about the costs of training in the alternative settings. Costs to be examined include not only such standard considerations as equipment, personnel, facilities, and supplies, but also the indirect consequences related to particular training strategies–for example, the effects of different experience mixes (trained and untrained men) in the force structure when training is conducted in operational units, the cost in productivity to experienced incumbents serving as instructors in on-the-job training, and the cost of different settings as a function of trainee characteristics (e.g., level of maturity and capacity for self-study). Thus, one study found an additional year of education to be associated with about a 10% reduction in estimated OJT costs, and an additional 10 points of measured mental ability, with about a 6% reduction.[1]

It is clear that this step involves an interface with other components of the operational system, beyond the training subsystem. The impact of the size of the partially trained component in the force structure and the impact on the operational unit of the amount of time and resources devoted to training cannot simply be ignored. A systems approach implies that no part of the system is free of the influence of the others. To assign tasks to different settings in such a way as to maximize total system effectiveness, then, requires knowledge of how alternative assignment patterns will affect the total system.

Summary of Requirements

Prerequisite Conditions and Information

1. Tasks can be assigned to any of several settings.
2. Information is available on costs of training in different settings.
3. Information is available on effects of training in different settings on total system effectiveness.

[1] Gay, Robert M., *Estimating the Cost of On-the-Job Training in Military Occupations: A Methodology and Pilot Study*, Rand, R-1351-ARPA, April 1974.

Procedures

1. Assign each task or group of tasks to its appropriate training setting.

Analysis of Service Models

ITRO Model. The ITRO model discusses five settings to which tasks may be assigned: job performance aid, self-teaching exportable package, formal on-the-job training, support school in operational setting, and resident school. The development of job performance aids in lieu of training is recommended whenever task delay tolerance and environmental conditions allow use of the aids, when the task does not require an aid of outsize proportions, and when successful performance is not dependent on a high degree of physical skill. Otherwise, each of the other four settings is considered, in the order listed. It is recommended that choices be made by first considering non-cost factors, then consulting local managers to revise selections as necessary in light of costs.

The ITRO model acknowledges that ordinarily not enough information is available on costs and effectiveness to allow rules to be formulated to prescribe specific settings. Instead, guidelines are given that "should prove helpful in making logical decisions."[1] Some of the factors discussed are amount of supervision required for a task, number and locations of trainees, learning decay rate, and training resources availability. The model points out that the expense of maintaining a program of instruction is not the only cost factor; development and implementation must be considered as well (e.g., since the Services differ in the extent to which on-the-job training systems are already in effect, they might rightly differ on selection of setting for the same task).

Marine Corps Order P1510.23B. The Marine Corps model indicates the same five settings as the ITRO model, and specifies that they be considered in the same order. Resident instruction is regarded as the most expensive setting, to be used only when no other will suffice. Some advantages and disadvantages are also discussed for job performance aids and on-the-job training.

Air Force Pamphlet 50-58. The model acknowledges that the choice of setting will seldom be left to the training developer, and provides no procedures. In interpreting this treatment, it must be kept in mind that AFP 50-58 is intended primarily for the use of flying training and technical training personnel responsible for developing resident instruction. Air Force Manual 50-2, which describes ISD in broader terms, states that "instructional system designers must evaluate the various alternatives for acquiring qualified personnel. Among the alternatives to be considered are the relative suitability of selective personnel assignment, OJT, the use of existing resident or field training courses, and the development of new resident or field training courses. Generally, a requirement for large numbers of personnel to be qualified over a long period of time can best be satisfied by the use of resident courses."[2]

Commentary. Neither of the models (ITRO and Marine Corps) that suggest procedures for selection of setting includes a methodology for determining which setting is optimal. If costs and effectiveness are to be measured and compared, the training designer will need to provide the procedures. The essence of the present procedures, then, is that formal training should be avoided if a job performance aid will suffice, and that settings other than resident training should be considered.

[1] *IPISD*, Block 1.5, para. 2-4.
[2] AFM 50-2, para. 3-4.

Development of Training Objectives and Objectives Hierarchies

The preceding steps, generally referred to as "front-end" analysis, have focused primarily on job requirements. The development of training objectives represents a shift in focus and is the first step in designing training to meet these requirements. It is a pivotal step in the ISD process because objectives provide the bridge between performing a task and learning to perform a task. Objectives are descriptions of what a trainee will be able to do following instruction. They thereby establish what behavior, when exhibited by trainees, will be accepted as evidence that instruction was successful. In turn, they become the goals for training and the determinants of test and instructional content. Training design and development from this point forward will be carried out with respect to the objectives rather than to the job tasks themselves.

Each objective describes some trainee behavior to be observed, the conditions under which it will occur, and the standard of proficiency that will be considered satisfactory. All objectives are derived from the tasks selected for training. They describe either task performance itself or behavior which demonstrates knowledge or basic skill required for task performance.

Objectives which describe task performance are given the name *terminal* (or task, primary, or criterion) objective. In managing instruction, tasks are sometimes divided into subtasks. Objectives which correspond to the performance of these subtasks are named *intermediate* (or sub-, enabling, supporting, or secondary) objectives. Objectives that refer to knowledge or basic skills that mediate the performance of tasks or subtasks are also termed intermediate objectives.

The process of developing objectives from tasks selected for training involves several steps:

- Deciding how closely capabilities for task performance, defined in terms of behaviors, conditions, and standards, at the conclusion of training shall match the requirements of the job. Those specified in a training objective may be identical to those identified in the original analysis of job requirements, or they may differ either because of constraints in the training situation or because it is not efficient to attempt to bring trainees completely up to job standards through formal training.
- Identifying objectives in a process referred to as hierarchical analysis. Here a task is successively broken down into its component parts and the skills and knowledge that are necessary to learn or perform each part. The analysis is taken down to the points where it is estimated that entering trainees would have the performance capabilities. The product of this analysis is a specification or hierarchical display of dependent and coordinate relationships within a task (terminal objective), among subtasks (intermediate objectives), and mediating skills and knowledge (intermediate objectives) for which training must be provided.
- Based on estimates of the abilities of entering trainees, deciding what performance capabilities must actually be developed during training. Selecting a task for training has implied that the task is important enough that trainees must possess some degree of proficiency in it following training. Because trainees already may possess the ability to perform all or part of a task as it has been defined for training, a determination is made of which performance capabilities will actually require instruction.

- Based on analysis of the task capabilities to be developed during training and upon estimates of abilities of entering trainees, deciding what knowledge and basic skills must be provided to mediate learning and performance. Learning or performing a task may require the prior acquisition of certain more fundamental skills (e.g., literacy requirements, mathematical skills, basic electronics knowledge) not observable or identifiable during task analysis. Like task performance capabilities, these skills may exist in some degree in the entering trainee population.

Summary of Requirements

Prerequisite Conditions and Information

1. Tasks selected for training are listed.
2. Information is available about training constraints that make it necessary to modify task requirements.
3. Information is available about how modification of task requirements will affect training efficiency.
4. Estimates of capabilities of entering trainees for learning and performing each task are available.

Procedures

1. Specify task requirements (behaviors, conditions, standards) for training.
2. Perform hierarchical analysis of tasks to identify intermediate training objectives.

Analysis of Service Models

ITRO Model. The ITRO model specifies that every task selected for training be used as the basis for an objective. This is accomplished by directly translating each Job Performance Measure into a terminal objective. This procedure automatically establishes the degree of fidelity of the training objective to the job task, since any necessary reduction in fidelity was incorporated into the Job Performance Measure.

Next, intermediate objectives are derived by analyzing the terminal objective in terms of what knowledge and skills would be required to attain it. In some cases, the resultant intermediate objectives will be the same as the elements of the task itself. In other cases, knowledge and skills not apparent from the task analysis may emerge as well, in a learning hierarchy. In all cases, the analysis is continued only until intermediate objectives are derived which are estimated to be within the capabilities of the entering trainees. This implicit estimate of entry behavior will later be verified using tests derived from the objectives.

Marine Corps Order P1510.23B. The Marine Corps model specifies similar procedures for deriving and verifying intermediate objectives. It also recognizes that knowledge and skills required to attain the objectives but not evident from task analyses alone may emerge when objectives are analyzed. Regarding the development of terminal objectives and their fidelity to job tasks, however, the Marine Corps model offers significantly less guidance than the ITRO. The introduction to the design phase of the Marine Corps manual states that "each task or task element selected for training" will become a terminal objective. It is not clear whether this means that some tasks and some elements, or all tasks and some elements, will be used. The section on developing objectives (paragraph 310) specified only that "the terminal objective must be related to a specific Job Performance Requirement," and not which Job Performance Requirements will become objectives.

No further guidance on this question is offered. Although the reader is directed to an appendix for further guidance, the appendix deals primarily with the clarity, specificity, and completeness of the objectives themselves, and does not include a procedure for deriving them from tasks.

Nor does the Marine Corps model contain a procedure for establishing standards and conditions for training objectives. In the absence of any guidance to the contrary, it might be inferred that the standards and conditions of the Job Performance Requirement with which the objective is "directly related" should be used. This interpretation is not wholly satisfactory, however, since some change in the standards or conditions is almost inevitable—especially for combat tasks. The lack of explicit directives for deriving objectives from tasks creates the possibility that products from different training developers will vary widely in quality.

Air Force Pamphlet 50-58. According to the AFP 50-58 model, objectives are derived directly from both tasks and elements of tasks. A determination is made for each task and element whether practice will be required in training to attain the standard set for it. Each task or element for which practice is judged necessary is considered a "new" skill or knowledge, and is accordingly translated into an objective (tasks into "task objectives," elements into "sub-objectives"). Those for which no practice is judged necessary are considered to be in the incoming trainee's repertoire. No objectives are developed for these.

In the AFP 50-58 model, then, the initial estimate of entry behavior is used not only to establish the level of detail of intermediate objectives, but also to delete certain tasks selected for training. The knowledge and skills that become training objectives in the AFP 50-58 model thus constitute a subclass of those in the ITRO and Marine models: ones which have been identified as (a) requiring a degree of proficiency unobtainable without practice in training, and (b) not in the incoming trainee's repertoire.

Since any task judged to be within the entry population's capabilities is eliminated from further consideration for the proposed course, this procedure amounts to a further selection of tasks for training—at least with respect to the deleted tasks. Thus the selection of tasks made on the basis of task priority information is ultimately subject to deletions made on the basis of estimates of entry behavior.

A "survey test" will later be given to verify this estimate, but its use is not equivalent to the later ITRO/Marine step "Verify Entry Behavior." In the ITRO model (and possibly also in the Marine Corps model), all tasks selected for training are subject to this method of verification. In the AFP 50-58 model, only tasks estimated to be a part of entry behavior are subject to verification. Since no objectives are derived from the deleted tasks, no tests are developed to measure them. The process will thereby identify only underestimates. Overestimation—the judgment that trainees are able to perform tasks which they really cannot—will not be revealed.

It is not clear whether the AFP 50-58 procedures identify knowledge and skills that are required to attain terminal objectives but are not themselves elements of job tasks. At one point, in describing the possible uses of the optional Instructional Planning Worksheet, the manual refers to "common-element" objectives as though they belong in that category. "Common-element objectives are not derived from specific Job Performance Requirements or Training Requirements recorded on the Training Data Worksheet."[1] This would suggest the existence of some procedure for developing objectives beyond that of considering each task and element listed on the Training Data Worksheet.

[1] AFP 50-58, Vol. III, para. 1-4a(2).

A little further in the manual, however, this is contradicted. A step-by-step procedure is given for deriving such objectives, beginning "(1) To identify common-element objectives, you must review all Training Data Worksheets to determine the skills and knowledge that are Training Requirements."[1] There is a column on the Training Data Worksheet for indicating, for each task or element, whether it calls for any knowledge or skill. This rightly acknowledges that some elements—perhaps even some tasks—might require neither. The instructions for doing this, however, do not suggest that skills and knowledge are being identified which are not part of the explicit description of the task. It appears more likely that the element or task is itself considered the skill or knowledge.

There is also a Notes column on the Training Data Worksheet, in which the trainer is instructed to explain his knowledge classification (or skill requirements). Yet, there is no further guidance to suggest that the explanation in the Notes column be converted into a separate objective. According to the instructions in AFP 50-58, any objective derived from this item will be a conversion of the action, conditions, and standard listed for the element or task on the Training Data Worksheet.

For deciding how closely the training objectives shall match job tasks, the AFP 50-58 model prescribes a two-part procedure. The conditions and standards originally determined for the task or element are to be used for the objective (with necessary allowances made for differences in conditions between the job and training environments). A second criterion is applied, however, before the standard becomes final. The standard for the objective should "reflect the proficiency level shown on the Training Data Worksheet."[2]

Proficiency levels are defined as " the *amount (extent) of knowledge or skill required* to perform a task or activity on the job."[3] Everything that follows in AFP 50-58, however, makes it clear that—at least as far as training design is concerned—proficiency levels are training standards, not job standards. They are determined on the basis of the "training factors" (task priority information). They indicate how proficient the graduate is expected to be upon arrival on the job. (In some cases, the Air Force specifies two levels: one the desired degree of proficiency, the other a lesser degree to be achieved in training when the desired degree cannot be reached because of training resource or other constraints. The unit receiving the graduate is then responsible for further training.) Proficiency levels range from "extremely limited" to "highly proficient" in skill, and, for tasks, from knowledge of "nomenclature" to "complete theory."

AFP 50-58 makes clear that, when this proficiency level is considered, the standard for the job will not necessarily become the standard for training. This is not wrong *per se*, but according to the AFP 50-58 model the job standard was used in determining which tasks would become training objectives in the first place. The criterion by which certain tasks and elements became objectives, and others did not, was whether the job proficiency requirement could be met by incoming trainees. For example, if the job task was to replace a certain component within 90 minutes, and it had been estimated that incoming trainees would be unable to do this without practice in training, that action became the performance part of an objective. If this task was performed infrequently and was not critical, it was later probably assigned knowledge proficiency level "a" and skill proficiency level "1". These would indicate that only nomenclature and simple procedures would be taught, and that the trainee would graduate with "extremely limited" skill, being unable to perform the task to "minimum acceptable levels of speed or accuracy."

[1] Ibid., para. 3-2d(1).
[2] Ibid., para. 2-4f.
[3] Op. cit., Vol. II, para. 3-13a.

If the trainee is not going to be trained to meet job proficiency requirements, then the question arises as to why his inability to meet them without practice in training is used as the basis for choosing objectives. In this example, the trainee is unable to achieve the task standard before training, and he is unable to reach it after training. Yet his inability to achieve it before training was the reason for translating this task into a training objective.

The hypothetical example is not an extreme one. AFP 50-58 specifies only the following conditions under which a trainee would be expected to reach "minimum acceptable levels of speed or accuracy" in training: when the task is critical or semi-critical and (a) there is a long time between training and performance, or (b) the task is hard to learn on the job, or (c) the task is both hard to learn on the job and rarely performed, in which case it must be critical, not just semi-critical. Many tasks, if not most, fall short of these criteria. Furthermore, if a "large majority of the incoming trainees have directly relevant prior experience on most elements of the task or activity," the proficiency levels for training are to be reduced one level—thus widening the gap between job standards and training standards still further.[1] It is easy to see how prior experience could enable trainees to meet specified standards in less time, but it is not clear why this would be a reason to lower the standards.

Commentary. Of the three models under discussion, the ITRO provides the most comprehensive, explicit, straightforward procedures for translating job requirements into training objectives. The Marine Corps model is unclear regarding how closely the objectives must match job requirements. The AFP 50-58 model permits the omission of any task or tasks which the trainees are estimated to know, without testing the estimate. Either of these "loopholes", as it were, might encourage what the Marine Corps model itself rightly identifies as a "weak practice"—writing learning objectives to match what is being taught, rather than to meet job requriements.

Development of Achievement Tests

When training objectives have been specified, it becomes possible to develop objective-referenced achievement tests. Such tests can be used for many purposes, such as determining the capabilities of the entry population, determining the effectiveness of training, and diagnosing student performance during training. They may take a variety of forms, depending on the nature of the objective being measured: performance tests can be used to assess behavior, paper-and-pencil tests to assess knowledge, and so forth.

A particular requirement of the ISD model is that tests be developed directly from objectives, rather than from the content of lessons. There are several reasons for this. Primarily there is the need for determining whether trainees have mastered the objectives. This is central to the ISD process. Also, the procedure helps insure, indirectly, that the content of a lesson will support its objective, since it must prepare the trainee to pass the test. If tests are based instead on lesson content, there is nothing to insure that lessons will pertain to objectives. Similarly, deriving tests from objectives is expected to inhibit the introduction of extraneous material into lessons, since the instructional developer's goals are clear.

Summary of Requirements

Prerequisite Conditions and Information

1. Training objectives have been specified.
2. Instructional materials have not been developed.

[1] Ibid., Fig. 3-14.

Procedures

1. Determine appropriate types of tests based on characteristics of objectives.
2. Construct tests to assess attainment of objectives.

Analysis of Service Models

ITRO Model. At least one achievement test item for an end-of-training test must be derived, from the Job Performance Measures, for each terminal and each major intermediate objective. It is not clear whether more than one item per objective is recommended. Guidance is not provided on sampling requirements for testing the transfer and application of information, concepts and rules, and skill. The actions, cues, conditions, and standards of these items are to be identical to those of the Job Performance Measures, unless additional constraints in the training situation require a reduction in fidelity. In addition, entry tests (to determine qualifications for entering the course), pretests (to be used for trainee placement within the course), and other within-course tests are developed if needed.

Marine Corps Order P1510.23B. Guidance similar to the ITRO model is presented in an abbreviated form. A test item is to be prepared for every terminal objective, and every enabling objective.

Air Force Pamphlet 50-58. The model requires first considering what resources are available for test development, and, if tests cannot be developed for all objectives, selecting the most important, according to a weighting formula provided. The model recommends developing a Course Criterion Test with items derived from task-level objectives, a Diagnostic Test (a pretest for placement purposes) with items derived from intermediate objectives, and a Survey Test comprised of both. The purpose of the Survey Test is to verify the assumptions about student entry behavior made when objectives were developed.

Commentary. All of the models require that tests be developed from objectives, rather than from the content of lessons. All provide some information about test construction, ranging from descriptions of different types of tests to discussions of such conventional topics as reliability and validity. The ITRO and Marine Corps models, however, provide little guidance concerning what an adequate test of an objective would be. They do not indicate how item content and form are to be selected or how content is to be sampled to test for the transfer and application of skill and knowledge. All models lack procedures for maintaining congruence between the actions and processes implied in an objective (e.g., remember information, use information, remember concepts, use concepts) and the actual requirements imposed by test items.[1]

Identification of Entry Behavior

As soon as tests have been developed, it is possible to verify the estimates of trainee entry behavior which provided the basis for deriving objectives in an earlier step. At that time, tasks were analyzed to identify their component parts and the skills and knowledge necessary to perform each part. In order to avoid reducing objectives to trivial

[1] For a procedure to assess the consistency of requirements among objectives, instructional activities, and tests, see Wulfeck, Wallace H., II, *et al., The Instructional Quality Inventory: I. Introduction and Overview*, Special Report 79-3, Navy Personnel Research and Development Center, 1978.

levels, an estimate was made of the performance capabilities, skills, and knowledge entering trainees would already possess. That estimate is now verified, before instructional development proceeds.

Since individuals who will be trained with this instruction probably are not available at this point, trainee entry behavior is determined by measuring performance of a group that is representative of the entry population in aptitude, experience, previous training, etc. If any objectives are found to be already a part of the incoming trainees' repertoires, they can be deleted from the proposed course at this time. On the other hand, the representative trainees may fail to attain objectives that had been estimated to be within their capabilities. These objectives are then analyzed further to derive lower order objectives; tests are developed for these subordinate objectives, and the new estimate of entry behavior is verified by administering the tests to another representative sample of trainees. This cycle is continued until a set of objectives is obtained that is consistent with the verified estimate of entry behavior. It is this refined set of objectives that will be used in subsequent ISD steps.

Later, after the instructional program has been implemented, entry tests and pretests can be used to measure entry capabilities directly. If these capabilities vary from the final estimate made in the present step, objectives can be added or deleted as necessary at that time.

Entry behavior is also assessed to diagnose trainee needs when instruction is individually prescribed. Here objectives are not modified, but rather training content is adjusted according to individual requirements for attaining the objectives.

Summary of Requirements

Prerequisite Conditions and Information

1. Objectives have been derived through hierarchical analysis of tasks.
2. Tests are available to measure objectives.

Procedures

1. Identify sample that is representative of trainees.
2. Administer tests to sample, and determine accuracy of earlier estimate of entry behavior.
3. Add or delete objectives as indicated by test results, and repeat cycle.

Analysis of Service Models

ITRO Model. The end-of-course test is to be administered to a sample of 25 to 30 trainees representative of those who will undergo the proposed instruction. The results are then used to revise the objectives. Objectives which the sample have already mastered are deleted. Those which were erroneously assumed to have been mastered are analyzed to a lower order; tests are then administered to another representative group, and the cycle is repeated until the objectives match the trainee entry level. When the trainees differ on whether they have already mastered an objective, it is recommended that pretests be developed to identify the entering trainees who do not need instruction. If it appears that the prerequisites for entry into the instruction are not sufficient to guarantee that trainees will possess necessary skills or knowledge, an entry test may be developed as well.

Marine Corps Order P1510.23B. The Marine Corps procedures are similar to those of the ITRO model, although test sample size is not specified. In addition, the Marine model specifies that all objectives corresponding to skills that all Marines in an MOS must perform correctly ("critical skills") shall be retained in the instruction, regardless of the performance of the trainees in the representative sample.

Air Force Pamphlet 50-58. The AFP 50-58 procedures are also basically the same as those in the ITRO model. The recommended minimum sample size for verifying entry behavior is ten. There appears to be a contradiction between the guidelines for using test results and the manner in which the objectives were developed. It will be recalled that tests were developed only for skills and knowledge that were estimated not to be in the entry population's repertoire. Yet the model specifies that instruction should be increased as needed whenever the students in the representative sample have greater difficulty than anticipated in exhibiting the task behaviors. If the behaviors were estimated to be outside their repertoires, then by definition it was anticipated the students would not exhibit them at all.

Commentary. Except for the contradiction mentioned in AFP 50-58, the procedures of any one of the models, if followed, would appear to be effective in adjusting the objectives to match trainee capabilities.

Classification of Objectives and Selection of Instructional Activities

Before instruction is written—even before any instructional medium is selected—the specific kinds of activities necessary to provide for learning are identified. In later steps, media will be chosen and instructional materials developed to support these activities.

Some activities are recognized as appropriate to all types of instruction, (e.g., inform the learner of the objective, elicit his performance, provide feedback). The most effective instructional activities, however, also differ according to the nature of the capability to be acquired, such as information, cognitive skill, or motor skill. Thus, information is acquired more readily if trainees are required to restate it in a context of related information; visual discriminations are learned more readily when critical stimuli are presented in different surrounds; acquisition of motor skill requires practice, and so forth.

Before instructional activities are selected, objectives are classified according to the type of capability they represent. Information about appropriate activities to promote learning for each type of capability is also essential. When objectives or groups of objectives have been classified, and the corresponding types of instructional activities identified, the activities themselves are specified (e.g., "Display varing views of the ships. . . . Provide three separate opportunities to disassemble the servo-mechanism"). These specifications will later be used to determine appropriate media and the content of instruction.

The choice of activities and the degree of detail required in specifying them will be greatly influenced by the nature of the behavioral requirements inherent in the objectives and how apparent they are. Some requirements will be self-evident in the conditions and standards of the objective. In other instances it will be necessary to analyze the objective (and perhaps be more specific in stating conditions and standards) before its behavioral requirements can be completely identified. When requirements are not immediately obvious, instructional activities must be specified in greater detail to provide sufficient guidance for selecting media and developing instructional materials in later steps.

Summary of Requirements

Prerequisite Conditions and Information

1. Information is available about types of instructional activities appropriate to acquiring different types of capabilities.

Procedures

1. Classify each objective or group of objectives according to type of capability.
2. Specify instructional activities for each objective according to type of capability.

Analysis of Service Models

All three models recognize four instructional guidelines as applicable to all types of learning: inform the learner of the objective; provide for active practice; provide guidance and prompts; provide feedback quickly. The models differ in the amount of additional guidance given for specifying instructional events for different kinds of learning, and also in the degree to which such specification is required.

ITRO Model. Each objective is to be classified as one of 11 types of learning (identifying symbols, performing gross motor skills, learning attitudes, etc.). Descriptions and examples of each learning type are provided. Next, it is recommended that about four learning guidelines be selected for each objective from among those specified, the number depending on type of skill (e.g., "Make the learning activities relevant by making them similar to real life tasks that the student will be performing on the job. . . . If students make incorrect actions or begin to develop bad habits, present a penalty following these improper responses until they disappear. . . . Display distinctive features of the pattern"). If these prove insufficient to assist learning, more can be added later. Each guideline is then converted into specific instructional activities unique to the objective (e.g., "Call attention to the differences between the two ships").

The ITRO model requires recording the type of learning and corresponding activities on the Learning Objective Analysis Worksheet (although the format illustrated in the manual provides space only for the learning category and not for the activities).

Marine Corps Order P1510.23B. The Marine Corps model acknowledges that "learning activities will vary depending upon the type of objective being taught," but does not indicate specific types, nor any learning guidelines specific to different types. It does require that whatever instructional activities are specified be recorded on the Consolidated Training Data Worksheet.

Air Force Pamphlet 50-58. The model states that "the lesson plan developed from the POI [Program of Instruction] should contain a complete, concise description of instructional events for each stage of learning."[1] The development of the POI is part of instructional design, while the lesson plan, apparently, will be developed by another party. Strictly speaking, then, AFP 50-58 does not require instructional events to be specified as part of the ISD process. However, a format is provided for such specification—the Instruction Planning Worksheet—to be used at the option of the training designer. Furthermore, AFP 50-58 provides guidelines for helping the student in six different types of learning. The manual discusses the relative advantages of part-task and whole-task practice, distribution of practice and rest, feedback, cues, and similar instructional factors.

Commentary. The ITRO model presents a large array of different "learning guidelines," covering 11 types of learning, from which instructional designers can select, while the AFP 50-58 model gives more prescriptive guidance and explanation for a smaller number of learning types. The Marine Corps model would not appear to provide sufficient guidance or direction to insure that this step is carried out.

[1] AFP 50-58, Vol. IV, para. 4-3c.

Selection of Instructional Methods

After instructional activities have been specified, instructional methods or delivery systems are selected. These are the ways in which trainees will be brought into contact with the instruction. These decisions involve such considerations as instructional group size and location (e.g., large group, seminar, individual study); degree of individualization of curriculum (e.g., fixed curriculum, remedial loops, branching programs); pacing (group or individually paced); management of the course (e.g., instructor-managed, computer-managed, self-managed, media-controlled); and who will provide one-to-one tutoring if required (e.g., instructor, peer, assistant instructor). Obviously, some methods are interdependent; it would be impractical to combine a high degree of individualization with group pacing, for example.

Methods are selected so as to maximize the effectiveness and efficiency of instruction, given the particular instructional activities, the nature of the trainee population, the setting, and administrative requirements and constraints. The choice of methods is influenced to a large degree by the kinds of instructional activities specified in the previous ISD step. For example, if trainees are to observe a live fire demonstration, it will be convenient to bring them together in a group; if they are to practice the procedure for preparing an accident report, individual study or peer instruction might be more appropriate. The choice of methods, in turn, will influence the selection of media in the next ISD step. If self-paced, individualized instruction is specified, for example, a live lecture will probably be precluded, but a videotaped one might be acceptable.[1]

Within the constraints of the factors just mentioned, methods are chosen on the basis of efficiency. Individualization, self-pacing, computer management, and similar methods have the potential for reducing the average time in the course, thus reducing total costs when large numbers of people must be trained. Use of such methods can raise development costs, however, and may not be efficient for training smaller numbers. The choice is also influenced by level and homogeneity of aptitude and experience of the trainee population, the probable life of the course, and the availability of facilities and equipment. Another consideration is setting; if the training is to be presented on the job, for example, peer instruction is often appropriate, while computer-managed instruction might be impractical.

Summary of Requirements

Prerequisite Conditions and Information

1. Setting has been specified.
2. Trainee characteristics have been identified.
3. Instructional activities have been specified.
4. Information is available on how the costs and effectiveness of alternate methods vary for specified settings, trainee characteristics, and instructional activities.

Procedures

1. Specify the methods of instruction to be employed for each objective or group of objectives.

[1] In the different ISD models, distinctions between instructional activities, media, and methods vary considerably, and some models combine certain of these steps. These differences are largely definitional and are to be expected, given the interrelated nature of these elements and the processes through which they are identified. For clarity, these elements are discussed here as different entities originating in discretely different steps.

Analysis of Service Models

ITRO Model. The ITRO model includes selection of methods in the step "Specify Instruction Management Plan and Delivery System," the same step in which media are chosen and a System Master Plan is developed. The model suggests that self-paced, individualized instruction is generally more effective than group-paced instruction. Different methods of managing students are presented for both group and individual modes. A glossary of methods and instructional devices is provided.

Marine Corps Order P1510.23B. The Marine Corps model also includes methods selection along with media selection. The model provides a matrix indicating some advantages and disadvantages of several methods. It is recommended that alternatives to the lecture be used if possible.

Air Force Pamphlet 50-58. The AFP 50-58 model contains a Methods Directory describing the characteristics of several methods and their applicability to different settings. The model notes that the stage of learning (early, middle, or late) will influence the choice of methods.

Commentary. All of the models describe and discuss different methods, and all encourage the consideration of alternatives to the traditional group-paced classroom lecture. While they specify the requirements which must be met (in terms of setting, group size, etc.) before a particular method can be used, they provide little information on which to base decisions about the relative effectiveness of different methods, either in general or with respect to their use with different trainee populations. Thus, while the models may be sufficient for rejecting inappropriate methods, they do not appear sufficient for selecting optimal methods.

Selection of Media

After instructional activities and training methods have been specified, and before instructional materials are developed, it is necessary to identify what media will provide an effective and efficient means for presenting the subject matter to the trainee. For example, if it has been decided that trainees should understand how the working parts of an engine operate, it must now be determined whether an operational engine, simulator, television or motion picture, still picture, diagram, computer-generated image, or other device is appropriate and, of those which are appropriate, which is most economical.

The nature of the instructional activities already specified determines which media can be considered. These activities were selected to expose the trainee to stimulus events and provide response opportunities that would promote learning. To be appropriate, media must allow those stimulus events and response opportunities to occur. If the instructional activity required the trainee to distinguish between naval signal flags, color would presumedly be required, but not motion. If the activity was to distinguish between target returns and noise on a radar scope, then motion would be required but not color.

Which medium is the most economical is a function of several factors, the first being the cost of the medium itself. Under most circumstances, for example, color costs more than black and white, motion costs more than no motion, audiovisual media cost more than printed forms. The previously selected methods also affect the choice of medium. For example, if self-paced instruction had been designated, tape/slide rather than lecture would be used to present verbal information; if group instruction had been designated, lecture could be used. Among other factors contributing to cost are existing investment in equipment, number of personnel to be trained, and availability and location of production facilities.

The procedure is to determine first which media satisfy the requirements imposed by the learning activities and methods that have been specified, and only then to consider costs. One prerequisite to selecting media, then, is information about the suitability of different media to different instructional activities and methods. Another is information about media costs and administrative factors that affect costs. In general, media are not selected on the basis of effectiveness *per se* since known characteristics that would make one medium more effective for certain instructional activities or methods are likely to have been incorporated when the activities were specified.

Summary of Requirements

Prerequisite Conditions and Information

1. Training designers are free to select from a range of media.
2. Instructional activities have been specified.
3. Methods of training have been specified.
4. Information is available concerning the appropriateness of different media to implement different activities to be used in conjunction with different methods.
5. Information is available concerning the costs of different media.

Procedures

1. Determine which media will be suitable to implement the instructional activities and methods.
2. Consider relative costs of media determined above and select most economical set of media.

Analysis of Service Models

ITRO Model. A two-part procedure is specified for selecting media. In the first part, matrices are utilized to select a set of possible media, based on the stimuli inherent in the learning activities, the complexity of the objective, the training setting, the development site, and the amount of available funds. In the second part, final selections are made on the basis of cost, practicality, existing investment in production facilities, resistance to innovation, and characteristics of the trainees such as reading ability. The first part of the procedure, then, is algorithmic, while the second part is judgmental.

Marine Corps Order P1510.23B. The Marine Corps model states that the use of media can "substantially enhance the learning process"[1] by stimulating more of the students' senses, presumedly in comparison to a lecture. This implies a slightly different definition of "media" from that of the ITRO model. In the ITRO model, the "traditional classroom" *is* one of several media. The Marine Corps model treats mediated instruction as an adjunct to, or substitute for, traditional methods. Perhaps for this reason, the Marine Corps model does not treat the matter of media selection in great detail.

A selection matrix for choosing media is provided, but no directions for its use.[2] The matrix displays six types of learning and 13 "Characteristics/Advantages of Media," such as "simplicity," "large classes," "realistic," and "motivation." If the type of learning is given, the matrix will yield from two to 16 appropriate media. Final choices would presumably then be made in the light of the characteristics or advantages corresponding to the media indicated. To use this matrix, it is first necessary to classify each learning objective according to type of learning. However, there is no explicit requirement in the

[1] MCO P1510.23B, para. 430.4d.
[2] Ibid., App. G.

Marine Corps model to do this, nor is there any space indicated on the Consolidated Training Data Worksheet to keep a record of type of learning.

Air Force Pamphlet 50-58. A media selection matrix and a procedure for its use are presented. The first step is to classify the knowledge or skill represented by each objective as either concrete (e.g., motor skill, classifying actual objects) or abstract (e.g., rules using language, verbal learning). This is done for early, middle, and late states of learning for each objective.

For each concrete skill or knowledge, the second step is to decide whether media are needed. The model states that actual job conditions and equipment are preferable. Media should be used only when certain specified practical and instructional constraints prevent the use of job conditions. The next step is to identify which of three stimuli—auditory, visual, and kinesthetic—are involved in learning the skill or knowledge. A guide is provided to aid this determination. The stimulus ("presentation mode") in turn determines the media options. When the matrix identifies more than one medium, a choice is made on the basis of group size, cost, instructor's role, and other administrative factors listed in a Directory of Media.

For each abstract skill or knowledge, the second step is to determine which of four presentation modes—auditory, visual, semi-motion, or interpersonal simulation—is required to express the concept associated with the knowledge or skill. If the concept can be expressed by spoken or written word alone, no medium is required. Otherwise, a matrix is used to determine media options, based on the specified presentation mode and the size of the group receiving instruction. If the matrix indicates more than one medium, a choice is made on the basis of the administrative factors listed in the Directory of Media.

Commentary. The appropriateness of different media to a given objective is determined in the ITRO model by considering the stimulus and response requirements of the instructional activities; in the AFP 50-58 model, by considering the objectives themselves; and in the Marine Corps model, primarily by the type of learning. In all cases, the accuracy of the determination would appear to depend on the skill of the analyst. None of the models provides guidance on how to determine stimulus requirements—only on how to match them to media.

The detailed procedures in the ITRO and AFP 50-58 models clearly represent a serious attempt to encourage users to consider a wide range of media. The incomplete treatment of this step in the Marine Corps model brings into question whether Marine Corps trainers are actually expected to do likewise.

Grouping and Sequencing of Instruction

To create a course of instruction from the diverse objectives that now exist, the next step is to determine and specify how they will be grouped and sequenced. An obvious factor that affects grouping is commonality of subject matter. Another is transfer of learning; to the extent that seems reasonable, objectives should be grouped together when some transfer of learning between them can be anticipated.

Two kinds of factors affect sequencing. One is the degree of dependency between objectives. If learning one objective depends on learning another, they must be sequenced accordingly. Where no dependency exists, more latitude is available and the process invokes the second factor, the set of overall sequencing principles chosen; simple to complex, job order, familiar to unfamiliar, most difficult first, most difficult last, etc. Unfortunately, there are no universal principles. In fact, a rationale can often be found for conflicting strategies. For example, sequencing topics on the basis of the order of job performance may often be most meaningful from the point of view of the learners,

yet it may sometimes result in giving the most exposure and rehearsal to the easiest and least important aspects of job performance. At present, decisions about sequencing of instruction must be based in part on individual judgment.

In addition to factors that pertain to learning, grouping and sequencing decisions are also subject to practical and administrative factors such as safety and availability of equipment and facilities. A principal characteristic of the ISD approach is that decisions about sequencing and grouping are made as much as possible on the basis of learning factors, rather than solely on the basis of administrative factors or past practice.

Summary of Requirements

Prerequisite Conditions and Information

1. Knowledge of the effects on learning of different sequencing plans is available.

Procedures

1. Identify commonality of subject matter and anticipated transfer of learning between objectives.
2. Identify degree of dependency between objectives.
3. Select overall sequencing principle(s).
4. Group and sequence objectives.

Analysis of Service Models

ITRO Model. Objectives are first categorized as dependent, independent, or supportive (those between which some transfer of learning occurs). The dependent objectives are then sequenced as necessary to insure that prerequisite learning will occur first. Next, supporting objectives are placed as close to each other as possible without interfering with the dependent sequencing. Independent objectives are sequenced last, in any order that is practical. The next step is to identify identical objectives and objectives with identical actions. Deletions are made to identical objectives so that each is taught only once. Objectives with identical actions, but different objects of the action, are grouped together.

Marine Corps Order P1510.23B. The Marine Corps procedures are identical to the ITRO, except that no mention is made of identical or identical-action objectives.

Air Force Pamphlet 50-58. The terminology used is slightly different from the ITRO/Marine models, but provides essentially the same procedures.

Commentary. The only unambiguous guidance from the Service models is to place dependent objectives later in the sequence of instruction than the objectives on which they depend. Given the inadequacy of knowledge about how different sequencing strategies affect learning, and the difficulty of estimating transfer of learning, this may well be all that the models can do, leaving the rest to the individual judgment of the training developer.

Development of Plan for Authoring and Managing Instruction

A written plan must be made available to those who will author, conduct, and manage the instructional program. Whether in a single master plan or in separate documents intended for the different personnel concerned, the decisions and specifications made in previous ISD steps must be transmitted to those who will carry them out. Thus, the content and structure planned for each lesson must be specified to those who

will author instruction. Information about the presumed literacy level, experience, age, etc., of the target audience will need to be provided, and the type and frequency of testing specified. The same information must be made available to the instructors and course managers. In addition, they must be informed about such administrative matters as class schedules, instructor allocations, and equipment and facilities use. All of this information is provided in a plan(s) for developers and managers of instruction.

Although the provision of a plan is discussed here as a distinct ISD step, the content of the plan so far as lesson specifications is concerned has been almost wholly determined by the decisions made in earlier steps which specifies the grouping and sequencing of objectives, instructional activities, methods, and media. If the earlier decisions and specifications about instructional design have been recorded in a form that successfully conveys this information to those who will use it, then a good portion of lesson specification has been accomplished.

What remains is to organize the course into its units/lessons, specify the objective(s) for each unit, and describe the instructional plan for each objective (e.g., how the trainee is to be informed about the objective, how stimulus material is to be presented and performance elicited, how guidance and feedback are to be provided). If, however, the decisions made earlier have not been recorded in usuable form, this must be done at this point as part of the lesson specification process, prior to authoring instruction.

In either case, decisions must be made about administrative matters such as class schedules and equipment use. Although such information may not be necessary to develop instruction, its development is included in this step for the sake of completeness. Actually, aspects of the plan that have no bearing on lesson specification can be developed either now or later, so long as the plan is complete before instruction is implemented.

Summary of Requirements

Prerequisite Conditions and Information

1. Objectives, instructional activities, methods, and media have all been specified.

Procedures

1. Specify the content and design of each lesson.
2. Specify how the instruction will be conducted and managed.

Analysis of Service Models

ITRO Model. The ITRO model specifies that a System Master Plan be developed to indicate how the course will be conducted, how students will be managed and tested, how instruction will be developed and evaluated, and other elements. Media specifications are made separately.

Marine Corps Order P1510.23B. The Marine Corps model specifies that a Consolidated Training Data Worksheet be constructed for each objective, specifying instructional strategies (methods), instructional activities, logistical considerations, and the main and supporting ideas for the instruction.

Air Force Pamphlet 50-58. The AFP 50-58 model specifies that the instructional activities, methods, guidance to the instructor, estimated instructional hours, equipment, and media required be specified for all objectives in a Program of Instruction (POI).

Commentary. Each of the models, then, requires that some plan or outline be provided. As mentioned, this step may be combined with others—as it is, for example, in the ITRO and Marine models. The adequacy of different models is discussed in the four preceding ISD steps where the information that constitutes the lesson specification is developed.

Review and Selection of Existing Materials

After instructional activities and media have been specified, and before development of instruction begins, any available existing instructional materials are examined to see if they match the specifications in whole or part. If they do, such materials can be utilized, with resultant savings in the next ISD step of authoring instruction. However, in addition to satisfying the requirements for instructional activities, methods, and media, such materials must also be appropriate to the expected trainee characteristics (experience, reading ability, education, etc.) and in harmony with the instructional management plan of the proposed course.

The distinguishing characteristic of the ISD approach in this step is that the suitability of existing materials is judged according to the specifications that have now been established for instructional activities, methods, and media. Although these specifications have some latitude that would allow changes in order to match existing materials, this is only permissible if the alternate activities, methods, and media are also appropriate to the objectives.

If existing materials are to be reviewed for their appropriateness to the newly established specifications, it follows that this review cannot precede such specification. Indeed, if existing materials are examined before activities, methods, and media are specified, it is all too easy for the former to influence the latter. The ISD approach is to determine what form the instruction should take according to what must be learned, not according to what materials happen to be available.

Summary of Requirements

Prerequisite Conditions and Information

1. Instructional activities have been specified.
2. Methods of training have been specified.
3. Media have been specified.

Procedures

1. Examine existing instructional materials to determine whether any meet the specifications for instructional activities, methods, and media.
2. Select materials or parts of materials that meet the specifications, or which could be efficiently revised.

Analysis of Service Models

ITRO Model. After instructional activities have been identified, existing materials are reviewed to determine whether some of the effort of developing new instructional materials can be avoided. This review is to extend to materials produced for other courses, in other Services, and in the civilian educational and training communities. Whether existing materials can be used in the course under development is determined by their appropriateness to the specified objectives, trainee characteristics, learning guidelines,[1] methods, and media. Materials that are nearly, but not entirely, adequate, may be revised. Moreover, some changes may be made in the specifications. The model states that the specifications for learning guidelines, methods, and media may be considered more flexible than those of trainee characteristics or the objectives themselves. Any materials selected must be subjected to validation in a later step.

[1] Learning guidelines are used in specifying instructional activities, see p. 31.

Marine Corps Order P1510.23B. The Marine Corps model places this step prior to determining methods and media. The adequacy of existing materials is determined by their appropriateness only to objectives, trainee characteristics, instructional activities, and test items. (The manual, perhaps by oversight, includes "instructional strategy" as a criterion. Instructional strategy, i.e., methods and media, is determined in the next step.) Only Marine Corps materials are considered in the review. There is no mention in this step of subsequent validation of selected existing materials, nor in the step "Validate Instruction," where the only instructional input listed is newly developed materials. The placing of this step ahead of determining instructional strategy would save the effort involved in selecting media and methods in those cases where existing materials, using existing media and methods, were judged adequate. However, a tendency might exist to adopt materials based on instructional strategies that were actually inappropriate, if the strategies had not been specified beforehand in an independent step.

Air Force Pamphlet 50-58. This model does not discuss the review and adoption of existing materials as a distinct ISD step. This would not, presumally, prohibit the use of existing materials in a course.

Commentary. Both the ITRO and Marine Corps models make clear that the selection of existing materials is to be based on specified characteristics of the materials, rather than simply on personal judgment. In considering the absence of this step in the AFP 50-58 model, it should be noted that there is also an absence, in the next ISD step, of any specific guidance for authoring instructional materials. Since the selection of existing materials is in lieu of developing new ones, the model is consistent when it omits both steps.

Authoring of Instruction

After existing materials have been reviewed, and suitable ones adopted or revised, new instruction is developed as needed. The content of instruction is determined by the earlier decisions on grouping and sequencing of objectives, instructional activities, methods, and media and by the specification of content for individual units/lessons provided in the authoring plan. The actual authoring process consists of such activities as writing scripts, and preparing tape/slide presentations.

ISD models are not intended to provide specific guidance with regard to the many technical skills needed in authoring instruction. Rather, the step is included in the models to specify its relationship to earlier and later steps and to indicate the empirical trial-and-error orientation of the authoring process.

As first drafts of instructional materials are produced, small portions are tried out on individuals who are representative of the entry population. The materials are then revised to correct weaknesses, omissions, and ambiguities.

A distinguishing characteristic of the ISD approach to authoring materials is initially to include only the bare minimum of instruction, and subsequently to augment instruction as needed. This approach is used to prevent the inclusion of extraneous material, which could easily be incorporated if an attempt were made to be comprehensive. Since instruction is deliberately designed to be just adequate, the tryout process is an essential part of ISD. Initial drafts are not expected to be completely satisfactory and it should be found necessary to augment instruction. Only through this progression can the economies of minimal instruction be assured. In a later step, quantitative information about the effectiveness of instruction will be obtained using larger groups of trainees, and further opportunity for revision will be available.

Summary of Requirements

Prerequisite Conditions and Information

1. Objectives have been grouped and sequenced.
2. Instructional activities have been specified.
3. Methods of training have been specified.
4. Media have been specified.
5. Lesson structure and content have been planned.

Procedures

1. Develop lean instruction.
2. Try out instruction on small number of persons representative of students.
3. Revise and augment instruction as necessary.

Analysis of Service Models

ITRO Model. The ITRO model specifies that only a minimum of instruction be included in first draft materials. This instruction is then tried out on one student at a time, and revisions made as needed. The ITRO manual provides general guidance for writing or developing many different types of materials: audiovisual scripts, slide/tape programs, television, programmed texts, and other printed materials, platform lectures, self-teaching exportable packages, job performance aids, and so forth.

Marine Corps Order P1510.23B. The Marine Corps model also specifies that only the minimum instruction necessary to achieve the objective be used. In addition, the model requires that a plan of the proposed instruction ("Concept Sheet") be approved prior to beginning work. No specific guidance on authoring materials themselves is presented. The model specifies that, if possible, instructional materials be tried out on "a single representative learner."

Air Force Pamphlet 50-58. The AFP 50-58 model specifies that materials be tried out on a small number of students, but not until they have first been subjected to an internal review by other subject matter experts. The model provides guidance on revising materials during the tryout phase, including how to remedy different types of failure to learn (retention, transfer, acquisition).

Commentary. All of the models, then, provide for a tryout of materials during development, and the ITRO and Marine models emphasize that instruction should be lean. The absence of specific authoring guidance in the Marine Corps and AFP 50-58 models should not be considered a deficiency, since description of the many different technical authoring procedures is not intended to be included in ISD manuals.

Validation of Instruction

After instruction has been developed but before it is put into use, it must be tried out to see if it works—that is, to see whether trainees attain the objectives. This is done by administering the course (or major parts of the course), under conditions that closely approximate its intended use, to groups of trainees representative of the entry population. Objective-referenced achievement tests developed prior to and independent of instructional development *per se* are the primary validation criteria. Other measures of instructional adequacy, such as time to complete lessons and acceptability to trainees, may also be obtained at this time. Instruction found to be deficient on any of the chosen criteria is revised and subjected to the validation process again.

Summary of Requirements

Prerequisite Conditions and Information

1. Objective-referenced achievement tests are available.

Procedures

1. Specify achievement test validation criteria (number and percent of persons in validation sample required to pass tests).
2. Specify additional validation criteria.
3. Present instruction, administer achievement tests, analyze results, revise instruction, and repeat cycle until validation criteria are met.

Analysis of Service Models

ITRO Model. The ITRO procedure is to conduct both individual and group validation trials. It must first be decided what types of information will be needed to measure the adequacy of the materials (e.g., achievement tests, student attitudes, time to complete lesson) and what criterion values will be considered adequate. Instruments for collecting and recording the data must then be developed.

Before trials are conducted, entry tests and pretests, if available, are used to select suitable subjects. In individual trials, while the instruction is being presented, trainee questions and any help given are recorded. When the trainee has completed the lesson, the post-test is administered, followed by attitude and/or other chosen measures. Following individual trials with from three to six trainees, the materials are revised in the light of test results, student comments, and whatever other data were collected. The model acknowledges that a good deal of judgment is required in diagnosing of deficiencies in the materials. When it is felt that the lessons are adequate, group trials are undertaken.

The model provides a method for determining the sample size needed to obtain statistically significant results in group trials, as a function of different standards for mastering objectives. Possible criteria to be used in setting such standards are similar to those used earlier in task selection (e.g., task delay tolerance, availability of trained incumbents, learning difficulty). The model cautions against being too rigid in setting standards, however, and acknowledges that a great deal of error is present in any attempt to measure performance. If the trainees fail to reach the criterion specified, the "revision cycle" (presumably the validation procedure) must be repeated. The ITRO model acknowledges that it may not be possible to complete validation before implementing the course, and that continual revision with the actual trainees may be required.

Marine Corps Order P1510.23B. The Marine Corps model specifies that instructional materials be tried with progressively larger groups and revised "until they are satisfactory." First, the materials are tested on a single representative learner, revised, and tried out again until "consistent errors are removed." Second, group trials are conducted until "the desired mastery criteria have been obtained." The manual states that "group, in this case, does not necessarily mean that the trials must be conducted with a group of a certain size." The Marine Corps model, like the ITRO, acknowledges that it may be necessary to validate materials by continual revision with actual trainees.

Air Force Pamphlet 50-58. The AFP 50-58 model also recommends a two-part validation procedure. In the first part, the instruction is presented to a group of six to ten students, evenly divided between low, medium, and high aptitude. Information about error rates, and time to complete, collected during this tryout is then used as the basis for revision. Instruction is then presented to another group of six to ten similar students. The cycle of instruction, test, and revision is continued "until it is proven that

the students can perform to the level specified in the criterion objectives and tests," or until at least 20 students have been through the instruction, whichever occurs later.

In the second part, complete instructional sequences (ideally the entire course of instruction) are presented to a group of about 30. This is called an "operational tryout," and is conducted using the equipment, facilities, and administrative procedures that will be used when the course is operational. If students fail to meet objectives, the model requires the designer to reassess the task analysis, objectives, tests, and instruction design and development.

Commentary. The procedures recommended in the different models are essentially similar, although the Marine Corps model allows considerably more leeway in the size of the sample for group trials. Any of the three sets of procedures, if put into practice, would be adequate to determine whether the training objectives had been achieved as measured by the achievement tests.

Internal Evaluation

After the instruction has been implemented, its actual effectiveness must be determined. Although validation in the preceding step indicated that persons who received the instruction would attain the objectives, this was only an estimate, based on an approximation of real training. How well the instruction works during actual training with actual trainees will now be determined. While validation occurred at one time only, internal evaluation will be continuous, since the capabilities of trainees and the manner in which instruction is conducted may change over time. The principal measure of instructional effectiveness is the trainees' performance on the objective-referenced achievement tests. Other measures include trainees' and instructors' opinions and attitudes concerning the instruction, time to complete lessons, and attrition rates. This evaluation of instructional effectiveness is sometimes termed product evaluation.

As deficiencies in the instruction are discovered, an attempt is made to identify their causes and recommend remedies. In locating the source of a problem, it will be important to know what ISD steps had previously been performed, what decisions were made, the rationales for these decisions, and the way in which they affected training. It would be pointless to consider revising the choice of particular instructional activities, for example, without first considering whether and how they had actually been incorporated into the instruction. This analysis or evaluation of how the ISD process itself was carried out is also part of internal evaluation, and is sometimes termed process evaluation.

Summary of Requirements

Prerequisite Conditions and Information

1. Records of students' performance on achievement tests are available.
2. Documentation is available of what occurred during the ISD process, including such elements as rationales for decisions, and departures from standard procedures.

Procedures

1. Specify evaluation criteria (number and percent of persons required to pass tests, etc.).
2. Identify the causes of shortcomings in the instruction and specify revisions.

Analysis of Service Models

ITRO Model. The ITRO model specifies that the effectiveness of both the instruction and the ISD effort itself be evaluated. Instructional effectiveness is measured by trainees' attainment of the objectives, as represented by test scores. The methods used are basically the same as validation procedures. The manual also recommends collecting information such as trainee background, entry skills, time to complete lessons, trainees' evaluations of the media and methods, and instructors' evaluation of the content. The product resulting from these activities is a report recommending revisions to improve the course.

The other aspect of internal evaluation—progress and process evaluation—is actually begun earlier. It begins with scheduling the ISD steps and determining which parts of each step will apply to the specific project. Then, as work proceeds, reports are made concerning quality, adherence to schedules, departures from plans, rationales for decisions, and other relevant factors. At the end of each step a report is made as to whether the products of that step are good enough to serve as input to ensuing steps.

Marine Corps Order P1510.23B. The Marine Corps model specifies that the following be evaluated, preferably by a person or group independent of course design and instructor personnel: (a) whether students are mastering the objectives, (b) whether the course was developed according to required procedures and schedules, and (c) whether the course is being administered as planned. A sample form is provided for use in recording trainee test performance. In the sample Evaluation Plan, it is recommended that when fewer than 80% of the trainees are mastering 80% of the objectives "the instruction will become suspect." Checklists are to be used to collect data on course administration. Student and instructor evaluations of the instruction are to be obtained. The product of this step is a set of recommendations to resolve problems and weaknesses.

Air Force Pamphlet 50-58. A quality control team, free from the influence of the instructional staff, is to conduct the internal evaluation. General qualifications for team members are listed in the manual. Part of the team's responsibility is to use the following procedure to evaluate trainees' mastery of objectives:

1. Select a random sample of students about to graduate, administer course criterion tests, and report the results. Before testing, the team decides what will be the passing score.
2. Administer the corresponding diagnostic test whenever there is poor performance on a course criterion test, to isolate the cause of the deficiency.
3. Scrutinize the part of the course where the deficiency seems to lie, and suggest ways to correct the deficiency.
4. After changes have been made, readminister the tests to graduates of the revised course.

The model does not specify sample sizes for the test program, but requires that, over a period of several graduating classes, each test be given. The quality control team is also responsible for examining and evaluating compliance with course control documents, performance of instructors, and the adequacy and appropriateness of training aids and equipment, supplies, and facilities.

Commentary. All of the models require that trainees' mastery of the objectives be used as a criterion for determining the effectiveness of the course. Any of the three sets of procedures, if put into practice, would be adequate to measure whether the training objectives had been achieved. The Marine Corps model, however, provides primarily an outline of the step rather than a detailed specification of procedures.

External Evaluation

In addition to determining whether trainees are attaining course objectives (internal evaluation), their proficiency and the adequacy of the instructional design and development process must be evaluated by a standard external to the course: the performance of the graduate on the job. If graduates are unable to perform certain tasks when they reach the job, and these deficiencies are unacceptable, the course may have to be revised. The purpose of external evaluation is to discover any such deficiencies, identify their causes (e.g., improper job analysis, inadequate training), and recommend remedies. If, for example, the job has changed since the original analysis, or if the analysis was faulty, the list of tasks on which the course is based may have to be changed. If the training product is not adequate, instructional activities or the objectives themselves may require revision. If skills and knowledge have been forgotten by the time they are needed, the remedy may be to increase training, train on the job, or shorten the time between training and performance in some other way.

Probably the most accurate methods of external evaluation are direct observation and testing of graduates on the job. Such approaches are costly, however, so some reliance, if not all, must be placed on supervisors' summary evaluations (ratings) of performance. Graduates' evaluation of their own and peers' performance may be included. Information also may be obtained on such factors as what tasks are performed, what aspects of training are perceived as insufficient, and what training is not used.

Whatever the source and type of evaluation information, it should be obtained at a task level of specificity. More general evaluations are of little use in isolating the causes of inadequate performance. In all cases, the external evaluation must take place fairly soon after the graduate has reached the field (usually within a few months). Otherwise, it will be difficult to discriminate between skills and knowledge acquired in training and those acquired on the job.

Summary of Requirements

Prerequisite Conditions and Information

1. Access to supervisors and job incumbents is possible soon after arrival of graduates on the job.

Procedures

1. Construct evaluation instruments (mail questionnaires, job sample tests, interview guides, etc).
2. Collect evaluation information.
3. Analyze data, identify causes of deficiencies, and specify revisions.

Analysis of Service Models

ITRO Model. Two questions are considered in external evaluation: Can the graduates perform their job tasks, and is the job the same as it was when originally analyzed? The recommended method of determining whether graduates can perform their tasks is to administer Job Performance Measures in the field 30-90 days after graduation. Basing decisions on data gathered by other means (questionnaire, interview, etc.) is described as far riskier.

Determining whether the original job analysis is still valid is seen as a matter of determining the present relationship between the Job Performance Measures and actual job requirements—that is, the predictive validity of the Job Performance Measures. Performance on the Job Performance Measures is compared with supervisors' evaluations of graduates' performance.

For interpreting the information from interviews and questionnaires, and deciding whether the course needs revision, the model acknowledges that no hard and fast rules apply. It provides guidance, however, on such questions as how to interpret data when a conflict exists between supervisors' ratings and Job Performance Measure results. The model cautions against revising simply for the sake of revision, and recommends making few, if any, changes if the majority of graduates and supervisors are satisfied with the quality of the training.

Marine Corps Order P1510.23B. The Marine Corps model states that the purposes of external evaluation are to determine whether the graduates are performing as trained and whether the job has changed since front-end analysis. The principal method is to survey graduates and supervisors, by questionnaire or interview, on how well they believe the graduates perform the job, the type and extent of training received on the job, the effectiveness and relevance of instruction, how graduates of the new course compare to graduates of earlier training, and similar points. In addition, the manual states that "the validators will attempt to determine how well the graduates scored on the Job Performance Measures and which JPMs gave them the most trouble."

Air Force Pamphlet 50-58. The AFP 50-58 model specifies that external evaluation may be accomplished by questionnaires, observation, interview, and formal supervisor's evaluation during the graduates' first two months on the job. Content of the evaluation instruments is to be based on the Job Performance Requirements and Training Requirements listed on the Training Data Worksheet. Examining the data collected from validation and internal and external evaluation is expected to show whether the graduates satisfy job performance requirements.

Commentary. The ITRO method, administering Job Performance Measures to graduates in the field, appears to be the most reliable way to measure the adequacy of the instructional design, but also the most costly. The ITRO model provides the most guidance for isolating the causes of performance discrepancies revealed during external evaluation. If summary evaluations are to be used, the ITRO and AFP 50-58 model both specify that information be obtained at the task level of specificity, while the Marine Corps model does not. The Marine Corps model is unique among the three in specifying a delay of six months, rather than two or three, before surveying graduates. A delay of this length might reduce the meaningfulness of the findings, since much of an incumbent's skill and knowledge at that point may have been acquired on the job, not in training.

SUMMATION

The adequacy of ISD and the Service guidance in general varies according to the kind of ISD step in question. Three general types of steps can be distinguished.

1. Procedural steps. Most ISD steps involve the direct application of procedures. The means for carrying them out are generally available. Examples are Identification of Job Requirements, Analysis of Tasks, Identification of Entry Behavior, Development of Achievement Tests, Validation of Instruction. The adequacy of ISD with respect to procedural steps becomes a matter of the clarity and completeness of the guidance.

Both the ITRO and AFP 50-58 models (with the exceptions noted in this chapter) appear adequate in this regard. The Marine Corps model is in the nature of an outline of what steps must be accomplished than a set of instructions for accomplishing them, and while it cites the ITRO model as a reference, there is every indication that it is intended to be sufficient by itself for carrying out ISD. The highly abbreviated form of the guidance makes its intent harder to discern, thereby presenting wider latitude for misinterpretation or misapplication.

2. Decisions affecting total system performance. These design steps involve decisions that interface with other components of the operational system and affect force effectiveness and productivity. The steps are Selection of Tasks for Training and Selection of Instructional Setting. Tasks selected for training establish the goals of training and thereby determine the output of the training subsystem. Thus, tasks must be selected on the basis of their contribution to overall system performance. The setting that is selected for training interfaces with other components of the system (e.g., it may reduce the productivity of supervisors who must devote time to on-the-job instruction) and should also be selected on the basis of its system effects.

To develop information about the relationship between system performance and criteria for selecting tasks and setting requires a criterion of system performance against which variations in task and setting can be tested. Currently available criteria of system performance such as those used to assess force readiness (e.g., personnel and equipment fill vs. authorization, deadline rate, hours on equipment, training status) are either insensitive to variations in training or not reliable. Because the effects of task and setting selection cannot be satisfactorily measured, ISD in general, and as represented by the Service models in particular, does not provide an adequate methodology for making decisions that affect total system performance. This fact is reflected in the lack of systematic procedures in the Service models for selecting tasks and settings.

3. Decisions affecting training system performance. These design steps involve decisions that affect the efficiency of training. The steps are Selection of Instructional Activities, Selection of Instructional Methods, Selection of Media, and Grouping and Sequencing of Instruction. Once the goals of training have been decided, decisions made in these steps determine the efficiency with which these goals are attained. The present state of the art of instructional design, however, provides only incomplete information for making these decisions.

Current guidelines for selecting instructional activities, methods, media, and sequence are rudimentary. They provide only the starting point for a trial-and-error approach to maximizing efficiency, which—given the number of possible combinations of methods—could not be expected to succeed. Thus, while ISD does provide a framework for comparing alternate strategies (if time and resources permit), it cannot be regarded as a methodology for achieving optimal training efficiency, given the current state of instructional technology.

Chapter 3

A MAIL SURVEY OF ISD APPLICATIONS

At the initiation of this study, staff members visited headquarters organizations in each Service to identify the locations of applications of Instructional System Development and to determine lines of authority and responsibility for ISD implementation.[1] Information obtained suggested the possible use of ISD in many organizations, far more than could be individually examined in the study.

In order to identify the organizations that were making maximal use of ISD procedures, an ISD Activities Questionnaire (see Appendix A) requesting descriptions of instructional development procedures was distributed to schools and units in each Service that were engaged in training and training development. The questionnaire was sent to Army schools by Training Developments Institute, Army Training and Doctrine Command; to Navy fleet training centers, technical training centers and training detachments by Chief of Naval Education and Training; to Navy air crew training units by Headquarters, Naval Air Systems Command; to Marine Corps schools by Headquarters, Marine Corps; and to Air Force MAJCOMS by the Directorate of Operations and Readiness, Headquarters, Air Force.

Because in some instances major commands reproduced the questionnaire and redistributed copies to subordinate units, it is not possible to specify exactly how many ISD Activities Questionnaires were distributed. The questionnaires were returned from a total of 209 organizations in the four Services.

In completing the questionnaire, respondents first listed all courses, either existing or under development, for which job analysis data had been compiled. Although we did

[1] Visits were made to:

Army
- Training Developments Institute, Training and Doctrine Command
- Training Support Center, Training and Doctrine Command

Navy
- Chief of Naval Operations
- Director of Naval Education and Training
- Chief of Naval Education and Training
- Naval Air Systems Command
- Chief of Naval Technical Training
- Naval Training Equipment Center
- Training Analysis and Evaluation Group
- Navy Personnel Research and Development Center

Marine Corps
- Headquarters, Marine Corps

Air Force
- Directorate of Operations and Readiness
- Directorate of Personnel Programs
- Air Training Command
- 4444 Operations Squadron (ISD) TAC
- Air Force Office of Scientific Research
- Technical Training Division, Human Resources Laboratory

not define ISD in terms of any specific type or sequence of activity, we did require that job analysis data be available for developmental efforts entered into the questionnaire. This was done to eliminate from the study instances in which ISD was considered to be nothing more than the application of one or more design or instructional techniques without the need for deriving training from job requirements.[1] Thus the sample was restricted to those efforts which treated the derivation of training from specified job requirements as a fundamental characteristic of ISD.

Across all Services a total of 1,814 training courses so defined were identified (Table 1).

Table 1

Training Courses With Job Analysis Data Available

Service	Organizations Responding	Courses
Army	16	357
Navy	65	459
Marine Corps	10	75
Air Force	118	923
Total	209	1814

Of the 209 organizations responding, 205 (98%) also provided information on the total number of courses they conduct, which is 5,934. Thus, job analysis data were reported to have been compiled and available for about 31-percent. Of these, job analysis data were reported to have been compiled and available for 1,648 (28%).

For the courses thus listed, a check list of 20 potential ISD activities was provided to identify the events that had occurred in course development (Table 2). Respondents indicated whether each potential activity had been undertaken, whether it had been completed, and whether products of the activity were currently available.

The questionnaire survey was intended primarily to provide information for selecting development efforts to be examined during subsequent visits. The data it generated are of limited value for analytic purposes since (a) respondents differed in their interpretation of the items in the checklist, and (b) the activities reported were later found to be exaggerated when checked in the organizations visited. However, the data are of some interest since they reflect to a certain degree the general pattern of ISD applications that was subsequently revealed in the field visits.

Percentages of responses for each ISD step conducted for each Service, and for all Services combined, are given in Tables 3-7. The greatest number of ISD steps performed

[1] Where training for specific jobs is being developed, requirements most often take the form of a listing of tasks to be performed. Where instruction is designed to meet educational goals, development may begin with a specification of more general capabilities (skill, knowledge) that are recognized to support many different activities. An explicit statement of either tasks to be performed or capabilities to be acquired is necessary for an objective determination of instructional requirements.

Table 2

Checklist of Potential Activities in ISD Activities Questionnaire

1. Analyzed probelm/system/existing course to determine need for training development.
2. Obtained priority information about tasks (frequency, delay tolerance, criticality, etc.)
3. Analyzed tasks into elements, conditions, and standards.
4. Selected tasks for training on the basis of task priority information.
5. Clustered tasks and selected instructional setting on the basis of priority information, resources, and output requirements.
6. Developed terminal and intermediate learning objectives.
7. Sequenced and clustered objectives.
8. Developed, tried out, and revised tests.
9. Identified knowledge and skills of entering trainees.
10. Identified type(s) of learning required for each objective, and specified corresponding learning activities.
11. Identified media appropriate to type of learning and learning activities.
12. Specified plan for pacing, instructor role, group/individualized presentation, scheduling, entry/exit requirements, etc.
13. Reviewed/selected appropriate existing instruction materials.[a]
14. Authored/produced new instruction materials.
15. Validated instruction materials.
16. Conducted instruction.
17. Analyzed student performance (for internal evaluation of course).
18. Revised training according to results of internal evaluation.
19. Determined if graduates were meeting performance requirements on the job (external/field evaluation).
20. Revised training according to results of external evaluation.

[a]This activity was inadvertently omitted from the questionnaire sent to Army organizations.

Table 3

Percent of Responses for Each ISD Step in 357 Army Instructional Development Efforts

RESPONSE CATEGORY	ISD Activities																			
	Determined Needs	Obtained Priority Information	Analyzed Tasks	Selected Tasks	Clustered Tasks Selected Setting	Developed Learning Objectives	Sequenced Objectives	Developed Tasks	Identified Entering Knowledges and Skills	Identified Types of Learning	Identified Media	Specified Management Plan	Reviewed Existing Materials[a]	Authored Instruction	Validated Instruction	Conducted Instruction	Internal Evaluation	Revised Training	External Evaluation	Revised Training	Mean
Activity Undertaken Products Available	65.8	75.6	76.5	77.6	38.7	35.3	30.2	29.7	34.5	28.3	27.7	37.0	--	33.3	15.7	23.5	14.0	13.2	7.8	5.9	35.1
Activity Undertaken Products Not Available due to Problems	3.4	5.0	1.4	1.7	5.0	3.9	2.0	0.3	1.4	6.2	5.9	3.1	--	2.8	2.8	0.3	2.5	2.5	0.3	0.0	2.6
Activity Being Undertaken Not Completed	2.5	13.5	14.3	10.3	43.7	39.8	40.9	43.7	47.6	40.3	40.6	41.4	--	47.9	53.5	49.6	50.1	51.0	62.8	55.7	39.4
Activity Not Undertaken	26.3	3.9	4.7	7.3	9.5	17.9	23.8	25.2	15.4	24.1	24.7	17.4	--	17.4	26.6	20.2	26.9	27.4	22.7	32.5	19.7
Not Reported	2.0	2.0	3.1	3.1	3.1	3.1	3.1	1.1	1.1	1.1	1.1	1.1	--	1.1	1.4	6.4	6.5	5.9	6.4	5.9	3.1

[a]Item inadvertently omitted from Army Questionnaire.

Table 4

Percent of Responses for Each ISD Step in 459 Navy Instructional Development Efforts

RESPONSE CATEGORY	ISD ACTIVITIES																				
	Analyzed System	Obtained Priority Information	Analyzed Tasks	Selected Tasks	Clustered Tasks Selected Setting	Developed Learning Objectives	Sequenced Objectives	Developed Tasks	Identified Entering Knowledge and Skill	Identified Types of Learning	Identified Media	Specified Management Plan	Reviewed Existing Materials	Authored Instruction	Validated Instruction	Conducted Instruction	Internal Evaluation	Revised Training	External Evaluation	Revised Training	Mean
Activity Undertaken Products Available	62.1	55.3	61.7	56.7	59.7	66.2	63.6	30.7	42.0	57.3	54.4	39.2	49.0	36.6	42.0	55.8	47.0	43.8	30.9	28.3	49.1
Activity Undertaken Products Not Available due to Problems	4.8	8.3	2.6	3.7	3.5	0.9	2.6	2.8	3.9	3.5	4.6	4.8	0.9	0.4	3.5	0.4	2.6	1.7	2.0	1.1	2.9
Activity Being Undertaken Not Completed	5.0	5.2	9.1	8.7	9.4	11.1	12.0	36.8	12.2	11.5	13.5	26.6	21.8	29.4	40.7	25.0	27.7	30.3	29.4	32.0	19.8
Activity Not Undertaken	28.1	31.2	26.6	30.9	27.4	21.8	21.8	27.7	39.9	25.7	25.5	27.4	26.3	31.2	11.8	16.8	20.7	22.2	35.8	35.3	26.7
Not Reported	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.0	2.0	2.0	2.0	2.0	3.3	1.4

Table 5

Percent of Responses for Each ISD Step in 75 Marine Corps Instructional Development Efforts

RESPONSE CATEGORY	ISD ACTIVITIES																				
	Analyzed System	Obtained Priority Information	Analyzed Tasks	Selected Tasks	Clustered Tasks Selected Setting	Developed Learning Objectives	Sequenced Objectives	Developed Tasks	Identified Entering Knowledge and Skill	Identified Types of Learning	Identified Media	Specified Management Plan	Reviewed Existing Materials	Authored Instruction	Validated Instruction	Conducted Instruction	Internal Evaluation	Revised Training	External Evaluation	Revised Training	Mean
Activity Undertaken Products Available	88.0	52.0	52.0	48.0	48.0	85.3	80.0	80.0	76.0	88.0	77.3	77.3	84.0	82.7	69.4	81.3	78.7	80.0	70.7	70.7	73.5
Activity Undertaken Products Not Available due to Problems	5.3	6.6	5.3	6.7	8.0	2.7	1.3	0.0	5.3	2.7	4.0	0.0	4.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	2.7
Activity Being Undertaken Not Completed	4.0	26.7	30.7	32.0	30.7	9.3	0.7	13.3	1.3	5.3	6.7	8.0	10.7	16.0	16.0	16.0	16.0	13.3	24.0	17.3	14.9
Activity Not Undertaken	2.7	14.7	12.0	13.3	13.3	2.7	12.0	4.0	17.4	4.0	12.0	14.7	1.3	1.3	13.3	2.7	5.3	5.4	5.3	12.0	8.5
Not Reported	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Table 6

Percent of Responses for Each ISD Step in 923 Air Force Instructional Development Efforts

RESPONSE CATEGORY	ISD ACTIVITIES																			
	Analyzed System	Obtained Priority Information	Analyzed Tasks	Selected Tasks	Clustered Tasks Selected Setting	Developed Learning Objectives	Sequenced Objectives	Developed Tasks	Identified Entering Knowledge and Skill	Identified Types of Learning	Identified Media	Specified Management Plan	Reviewed Existing Materials	Authored Instruction	Validated Instruction	Conducted Instruction	Internal Evaluation	Revised Training	External Evaluation	Revised Training	Mean
Activity Undertaken Products Available	72.8	57.6	68.6	62.9	62.0	68.2	70.1	55.6	59.9	69.1	69.6	71.7	75.6	68.5	55.1	64.7	62.9	54.9	50.7	46.6	63.4
Activity Undertaken Products Not Available due to Problems	18.3	16.8	10.7	13.1	18.2	10.0	8.0	7.6	14.7	5.2	6.8	3.4	4.6	3.5	10.8	6.2	4.9	5.4	4.8	4.6	8.9
Activity Being Undertaken Not Completed	4.0	6.3	6.4	6.2	8.8	11.4	11.3	19.3	5.8	11.7	10.6	11.8	11.5	16.3	23.4	19.5	22.0	25.6	23.1	22.9	13.9
Activity Not Undertaken	4.9	19.3	14.3	17.8	11.0	10.4	10.6	17.3	19.5	13.9	12.9	13.0	8.2	11.5	10.4	9.2	9.8	13.7	20.8	24.6	13.7
Not Reported	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.6	1.3	0.2

Table 7

Percent of Responses for Each ISD Step in 1814 Instructional Development Efforts: All Services Combined

RESPONSE CATEGORY	ISD ACTIVITIES																				
	Analyzed System	Obtained Priority Information	Analyzed Tasks	Selected Tasks	Clustered Tasks Selected Setting	Developed Learning Objectives	Sequenced Objectives	Developed Tasks	Identified Entering Knowledge and Skill	Identified Types of Learning	Identified Media	Specified Management Plan	Reviewed Existing Materials	Authored Instruction	Validated Instruction	Conducted Instruction	Internal Evaluation	Revised Training	External Evaluation	Revised Training	Mean
Activity Undertaken Products Available	69.3	60.4	67.7	63.6	56.2	62.0	61.0	45.2	51.0	58.9	57.8	56.9	67.7	54.1	44.6	55.0	50.0	44.9	38.1	35.0	55.0
Activity Undertaken Products Not Available due to Problems	11.4	11.9	6.6	8.2	11.5	6.2	5.2	4.6	9.0	4.8	6.0	3.5	3.3	1.9	7.0	3.3	3.6	3.7	3.0	2.7	5.9
Activity Being Undertaken Not Completed	4.0	8.2	9.7	8.7	16.7	16.8	17.1	28.3	15.4	17.0	17.1	21.2	14.7	25.9	33.4	26.7	28.7	31.3	32.5	31.4	20.2
Activity Not Undertaken	14.9	19.1	15.4	18.9	15.0	14.4	16.1	21.0	23.8	18.5	18.3	17.6	13.6	17.2	14.1	13.0	15.7	18.2	24.3	28.3	17.9
Not Reported	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.9	0.8	0.8	0.8	0.8	0.7	0.9	0.9	2.0	2.0	1.9	2.1	2.6	1.1

(i.e., highest mean percentage of responses for all potential activities in the category "activities undertaken/products available") is reported by the Marine Corps (73%), followed by the Air Force (63%), the Navy (49%), and the Army (35%).

The relatively low overall incidence of ISD activity reported by the Army is a consequence of their current focus on developing exportable training and evaluation materials for use in operational units (e.g., Soldier's Manuals, Training Extension Course lessons, and Skill Qualification Tests), rather than instructional development *per se* (see Chapter 4). This is seen more clearly when the percentages of responses for different types of ISD activities are examined. Three major phases of ISD are (a) analysis of job and training requirements, (b) development of instruction, and (c) evaluation of instruction. Items from the activities checklist that most clearly represent each of these phases were selected. The mean response percentages in the category "activities undertaken/products available" for each phase by Service are shown in Table 8.

Table 8

Level of Activity in Three Phases of ISD

Service	Mean Percent of Responses Indicating Activity and Products		
	Analysis[a]	Development[b]	Evaluation[c]
Army	76.6	30.6	9.4
Navy	57.9	60.4	40.0
Marine Corps	50.7	82.6	72.9
Air Force	63.0	65.5	56.2
All Services Combined	63.9	59.9	44.2

[a]Based on items: Obtained priority information about tasks (frequency, delay tolerance, criticality, etc.); analyzed tasks into elements, conditions, and standards; and selected tasks for training on the basis of task priority information.

[b]Based on items: Developed terminal and intermediate learning objectives; sequenced and clustered objectives; identified type(s) of learning required for each objective and specified corresponding learning activities; and identified media appropriate to type of learning and learning activities.

[c]Based on items: Validated instruction materials; analyzed student performance (for internal evaluation of course); and determined if graduates were meeting performance requirements on the job (external/field evaluation).

In Army applications, only 35 percent (Table 3) of the responses for all types of activities indicated actions and products, whereas activity is shown in 77 percent (Table 8) of the steps concerned with analysis of job and training requirements. Front-end analysis is necessary in the development of Soldiers Manuals and prescribed for the construction

of Skill Qualification Tests.[1] The pattern reported by Army organizations clearly reflects these activities.

The other noteworthy aspect of these data is the relatively low level of activity in evaluation. With the exception of the Marine Corps (with data representing a smaller number of applications and a far smaller number of organizations), all Services report a lower level of activity in evaluation than in either analysis or development. Also less activity is reported by the Army, Navy, and Air Force for any of the three subclasses of evaluation (validation, internal evaluation, external evaluation) than for analysis or development (Table 9). External evaluation was reported least frequently.

Table 9

Level of Activity in Three Types of ISD Evaluation

Service	Percent of Responses Indicating Activity and Products		
	Validation	Internal Evaluation	External Evaluation
Army	15.7	14.0	7.8
Navy	42.0	47.0	30.9
Marine Corps	69.4	78.7	70.7
Air Force	55.1	62.9	50.7
All Services Combined	44.6	50.0	38.1

[1] William C. Osborn, Roy C. Campbell, and J. Patrick Ford. *Handbook for Development of Skill Qualification Tests*, HumRRO Final Report 77-1, January, 1977.

Individual Training and Evaluation Directorate, U.S. Army Training Support Center. *Guidelines for Development of Skill Qualification Tests*, December 1977.

Chapter 4

SERVICE METHODS OF ORGANIZING FOR ISD

The Services differ widely, both among and within themselves, in the ways in which they have organized to meet the requirements of Instructional System Development. In part, their responses reflect different notions of what the ISD requirements are, and in part simply the different situations faced by the four Services. At the most universal level, there is recognition of the need for information about the ISD process and for expertise to carry out its individual steps. One response to this need has been to revise instructor training courses to concentrate on skills and knowledge related to ISD rather than on the traditional content, methods of effective instructional presentation. Another response has been to specialize, partitioning the ISD process into several phases and assigning personnel to develop expertise and to work on only one phase. Another approach has been to assign personnel permanently to ISD duties, with or without specialization in a single phase. Expertise has also been brought to bear by engaging civilian contractors to accomplish ISD or to participate in joint military/contractor development efforts.

The need for expertise, or the lack of it, is also reflected in the degree to which ISD activity has been centralized. One view is that expertise can be acquired by instructors at all training sites, and that they should be required to apply ISD as they develop and revise their own courses. At the other extreme is the view that expertise is both limited and hard to acquire. This has led to the deliberate placement of personnel at a limited number of sites, to develop training to be conducted at other locations. This permits the use of personnel who already possess backgrounds in training design or development, and who can be expected to acquire further expertise through a succession of ISD efforts. Centralizing ISD activity in this way, however, means that instructors must be willing to accept training material they did not develop themselves. Resistance to doing so is widely acknowledged, and is sometimes termed, aptly, the "not-invented-here syndrome."

In addition to the need for expertise, there is some belief in the desirability of performing various steps separately in order to maintain the high degree of objectivity implicit in ISD. To keep the determination of job requirements, for example, insulated from the influence of either what has previously been taught or what certain persons believe should be taught, some training personnel believe that job task lists should be developed by persons other than instructors. Another example is the obvious appropriateness of assigning the responsibility for evaluating training to others than those who develop it.

To separate the ISD functions requires, of course, that each party be willing to use the products developed by others. This situation is analogous to that of centralized instructional development, and the degree of resistance may be just as high between job analysts and training analysts, for example, as between developers of training and instructors.

Another difficulty inherent in separating ISD functions is achieving the appropriate degree of communication between those performing separate steps. Too much communication threatens to compromise objectivity, but some is necessary both because the steps are so interdependent, and because subject matter experts (often the course instructors) must provide input at several points.

The manner in which the individual Services have organized to apply ISD is summarized in the following sections.

ARMY

Training is developed at the TRADOC resident training center proponent for a particular MOS. TRADOC has organized its schools along the lines of the ITRO model for ISD, with separate directorates or divisions for different ISD functions. Thus, for example, a task list developed in a Training Analysis Division of a Directorate of Training Developments would be handed off to a Course Development Division for the development of training, and the resulting training would be evaluated by the Directorate of Evaluation. (The exact arrangement varies from school to school.) The responsibility of each division, however, is primarily the generation of one or more products for the Enlisted Personnel Management System (EPMS) for use outside the school. These include lists of training tasks for each MOS (Soldier's Manuals and Commander's Manuals) and evaluation instruments and training materials based on these lists (Skill Qualification Tests, Army Training and Evaluation Program tests, Training Extension Course lessons).

Resident training, not being one of these EPMS products, is not necessarily based on the same task lists. It is generally developed by instructors in training departments, independently of the analysis and design activities of the various divisions in the school. The activities of these divisions, then, do not usually lead to the systematic revision of training, at least initial training, for an MOS. When ISD is applied to resident training, it typically follows a decision to convert a course to self-pacing. In such cases, an *ad hoc* team is sometimes assembled to carry out the process.

NAVY

For initial "A" School technical training, the Navy has centralized ISD activity at Instructional Program Development Centers (IPDC), under the Chief of Naval Education and Training Support. Two centers have been established; more are planned. One course developed at IPDC San Diego has already been turned over to Chief of Naval Technical Training (CNTT) for implementation.

To the extent that the IPDC approach is pursued, the responsibility for designing and developing "A" School courses will be removed from the schools, which will be responsible only for conducting the training. This arrangement has ostensibly been chosen because training technologists needed to support ISD cannot be made available everywhere training is conducted. Centralization of training development also presumably permits more effective control of the ISD process. Whether such control is achieved remains to be seen. The IPDCs are staffed primarily by civilian education specialists and instructional materials developers. Subject matter expertise is provided by the instructors of the existing courses, who also, to a large extent, determine what tasks should be trained.

Since the IPDC approach is only beginning to be implemented, most Navy "A" School courses are still developed and revised at the technical training center where they are taught, by course instructors and civilian education or training specialists. A Curriculum and Instructional Standards Office is typically responsible for coordinating approval of the course by CNTT. More advanced training at Naval Air Maintenance

Training Detachments and other training centers under CNTT is also locally developed and subject to CNTT approval. An analogous situation exists for training conducted by the Atlantic and Pacific Fleet Training Commands.

Another area of major ISD effort in the Navy is aircrew training. The Naval Training Equipment Center (NTEC) has sponsored several large-scale analysis and development projects by civilian contractors, for new or updated aircraft (one aircrew training squadron has also undertaken its own effort, patterned after the contractor-developed procedures). In some cases the projects have been limited to analysis and design of training. When instructional materials have been developed as well, the emphasis has been on self-paced audiovisual and printed media to replace much of the instruction that was formerly conducted by a one-to-one tutorial or in the group-paced lecture/demonstration mode. NTEC has also developed specifications to guide and control future ISD efforts conducted by civilian contractors.[1]

MARINE CORPS

The Marine Corps has not instituted a new form of organization to implement ISD, but rather has concentrated on teaching ISD procedures in its instructor training courses. Formal training is developed at the resident school where it is conducted, primarily by course instructors. (Civilian education specialists also participate in course design to some degree, especially in the preparation of course control documents for approval.) The Marine Corps policy is to require all instructors to apply ISD whenever they are developing a new course, but not to revise existing training that had been developed in accordance with the Marine Corps' earlier nine-step "systems approach" model for training development.

The extent of application of ISD has been quite limited. There are instances, however, in which training has been redesigned or developed using some of the ISD steps. The personnel involved ranged from one instructor or education specialist to an *ad hoc* team of several instructors, sometimes organized under the name of a Course Content Review Board. When such teams are used to design training, the actual authoring of instruction (generally lesson plans) is still generally accomplished by the instructors who will use it.

AIR FORCE

Technical training by instructors in the Air Force is developed at the resident schools where it is conducted. Instructor training has therefore been revised to include ISD techniques. In addition, an ISD Specialty has been added to the Air Force job structure. ISD Specialists and civilian education specialists provide guidance to the instructors who are developing or revising their courses, and they coordinate approval of the course objectives (Program of Instruction) by Air Training Command (ATC). At the time of this report, the future of the ISD specialty is in some doubt.

The application of ISD to Air Force technical training is greatly conditioned by certain components of the existing training development system. An occupational measurement squadron is responsible for providing job task lists to schools. For each

[1] Military Specification MIL-T-29053, *Training Requirements for Aviation Weapon Systems*, 1977.

course, schools are required to publish a Course or Specialty Training Standard that lists tasks selected for training. A list of training objectives must be published in the form of a Program of Instruction. To a large extent, the application of ISD in technical training consists of satisfying these documentation requirements.

The application of ISD to aircrew training is more centralized. For each aircraft, training is developed at a single site, although it may be conducted at several. As in Navy flying training, major ISD efforts are being undertaken to develop individualized (usually audiovisual) instructional materials and to substitute simulator hours for flight time. The typical approach is the use of an ISD team, either from an ISD squadron or as a part of the flying training squadron or wing where the training is being developed. Although team members may be aircrew personnel assigned to ISD duties, they are not the flight line instructors who will teach the course. This degree of separation of functions has the potential to increase the degree of objectivity in the job and training analysis, but also presents the problems of communication and resistance inherent in any effort to separate training development from implementation.[1]

SUMMATION

No particular method of organizing for ISD (centralization or decentralization, separation of functions or unitary approach) was found to promote or hinder its application. To a certain extent this finding reflects several difficulties encountered in trying to assess the relative effectiveness or efficiency of alternate approaches:

(1) None of the training design efforts examined followed ISD procedures closely enough so that the adequacy of the resulting training could be considered a measure of the adequacy of ISD, much less of a particular approach.

(2) Data on the cost of applying ISD, on which to base comparisons of efficiency, were seldom available.

(3) The ISD efforts that were examined cover a range of types of training in different content areas. Measuring the effectiveness of alternate organizational approaches would require that the costs and effects associated with the way the ISD process has been structured be identified and isolated from the costs and effects associated with particular training methods or jobs.

These difficulties notwithstanding, the research team's conclusion after examining 57 courses is that whether or not ISD procedures are closely followed is not a function of the manner in which people are organized to apply it. At least within the range of approaches represented in the study, none was found to be superior.

It was also found that separating ISD functions does not of itself insure a high degree of objectivity. When the effort is made to insulate one ISD activity from the influence of another or from past practice, by handing off ISD products from one party to another, the products are often modified to suit those who receive them. This applies to hands-offs both among instructional developers and from developers to instructors.

[1] See Miller, Ralph M., Swink, Jay R., and McKenzie, James F., Jr., *Instructional Systems Development (ISD) in Air Force Flying Training*, Air Force Human Resources Laboratory TR-78-59, 1978.

ISD is typically performed by a small team. Even when some other form of organization has been formally established to carry out ISD, there is a tendency to revert to a small team. In the Marine Corps and in flying training the team approach is standard; in other instances teams are often assembled *ad hoc*.

ISD is generally performed by instructors. Of the 57 training design efforts studied, instructors were primarily responsible for 39. Moreover, even when analysis and design are accomplished by others, the actual authoring of instruction is often performed by those who teach the course.

Chapter 5

FIELD STUDY OF ISD APPLICATIONS

FIELD STUDY OF COURSES

Information about how ISD is being applied was obtained by examining the procedures used in developing or revising 57 courses at 33 organizations in the four Services. Training developers who had participated in course design described how training had been developed and implemented in each case. The initial identification and screening of installations to be visited and courses to be examined was made on the basis of information obtained in the questionnaire survey described in Chapter 3. The strategy used in identifying sites was to seek out courses that provided the most complete representation of the ISD process. This appraisal was verified in phone conversations prior to a visit and again upon arrival at the site. Occasionally a course that had been previously selected was deleted, and one that developers felt represented a better example of their best efforts to employ ISD was substituted. The sample of courses that was examined represents the *best examples of ISD* that were identified. Thus, the sample is exemplary rather than typical.

In many cases several persons provided information about a given course. Each step of the design process that had occurred was first identified; then the procedures and products for each step were described and discussed in detail. Each interview covered only a single course and how *it* was developed. This approach resulted in a body of data consisting of a *collection of specifics* rather than a collection of general procedures. A structured format to the interview provided for cross-questioning, to check on the accuracy of the information.[1] In almost all instances, however, interviewees proved to be quite candid in their descriptions of what they had and had not done.

As indicated in Table 10, courses were examined in each Service. Combat, air crew, and technical training, both maintenance and non-maintenance, are represented. The sampling of courses, however, is not related to such factors as combat importance or input density. Instead, an effort was made to include examples of as wide a range of types of training as practical. Intentionally avoided were courses with a strong educational and informational orientation, non-job-specific courses, and others in which it is difficult to identify specific behavioral objectives (e.g., Service academies, leadership, organizational effectiveness).

The remainder of this chapter contains a step-by-step description of the way in which the ISD process is being applied. It is organized like Chapter 2, discussing each ISD step in turn. Following a summary description of each step[2] are a table listing prerequisites and procedures for carrying out the step; statistics on the number of courses in which the prerequisites were present and the procedures were carried out; and a general description of the way in which the step has been applied. The chapter concludes with a general discussion of how ISD is being used. In Appendix B, the data on the individual steps summarized for all Services in this chapter are broken down by the individual Services.

[1] Copies of the interview guide can be obtained from HumRRO, Western Division.

[2] Each step, previously described in Chapter 2, has been summarized so that the present chapter can be read independently. The reader who has read Chapter 2 may wish to skip over the introductory [illegible] of each step.

Table 10

Courses Examined

ARMY

- Short Range Air Defense Missile Crewman
  - Air Defense School, Fort Bliss, Texas
- Infantry Officer Advanced
  - Infantry School, Fort Benning, Georgia
- Field Artillery Crewman
  - Field Artillery School, Fort Sill, Oklahoma
- Aerial Surveillance Sensor Repairer
  - Intelligence School, Fort Huachuca, Arizona
- Tracked Vehicle Mechanic
  - Armor School, Fort Knox, Kentucky
- Improved Hawk Fire Control Repairman
- Nuclear Weapons Electronic Specialist
  - Missile and Munitions School, Redstone Arsenal, Alabama

NAVY

- Avionics Technician
- Basic Electricity and Electronics
  - Naval Air Technical Training Center, Memphis, Tennessee
- Aviation Storekeeper
- Aviation Maintenance Administrationman
- Personnelman
  - Naval Technical Training Center, Meridian, Mississippi
- Propulsion Engineering
- Fire Control Technician
  - Service Schools Command, Great Lakes, Illinois
- Radioman
- Internal Communicationman
  - Instructional Program Development Center, San Diego, California

(Continued)

Table 10 *(Continued)*

- F-4J Electrical Systems Organizational Maintenance
  - Naval Air Maintenance Training Detachment 1024, MCAS Beaufort, South, Carolina
- AN/APM 225 Module Analyzer Test Console
  - Naval Air Maintenance Training Detachment 1003, NAS Oceana, Virginia
- SH2F Airframe Maintenance
  - Naval Air Maintenance Training Detachment 1007, NAS Norfolk, Virginia
- Hagan Automatic Boiler Control Console Operator
- Storekeeper Supply Afloat Independent Duty
- AN/SPS 49 Heavy Radar Maintenance
  - Fleet Training Center, Norfolk, Virginia
- Nuclear Weapons Advanced Maintenance
  - Nuclear Weapons Training Group Atlantic, Norfolk, Virginia
- Surface Anti-Submarine Warfare Officer
  - Fleet Anti-Submarine Warfare Training Center Atlantic, Norfolk, Virginia
- OK-252/BQR-15 Array & Cable Handling Group
- MK24 Hydraulic/Support Ring Advanced
  - Fleet Ballistic Missile Submarine Training Center, Charleston, South Carolina
- P-3C/P-3B MOD Aircrew
  - Patrol Squadron 31, NAS Moffet Field, California
- F14 Aircrew
  - Fighter Squadron 124, NAS Miramar, California
- SH-3H Aircrew
  - Helicopter Anti-Submarine Squadron 10, NAS North Island, California
- Basic Underwater Demolition and SEAL
  - Naval Amphibious School, Coronado, California

MARINE CORPS

- Instructional Management
- IBM 360 Systems
- Communications Officer
  - Education Center, Development and Education Command, Quantico, Virginia

(Continued)

Table 10 *(Continued)*

- Motor Transport Staff NCO
  - Motor Transport School, Camp Lejeune, North Carolina
- Food Service Basic
- Fiscal Accounting
  - Service Support Schools, Camp Lejeune, North Carolina
- Journeyman Combat Engineer
  - Engineer School, Camp Lejeune, North Carolina

AIR FORCE

- Television Equipment Repairman
- Technical Instructor
- Services Operations Officer
- Instrumentation Mechanic: Sets Training
- Material Facilities Specialist
  - Lowry Technical Training Center, Colorado
- Dental Supervisor
- Optometry Specialist
- Mental Health Ward Specialist
  - School of Health Care Sciences, Sheppard AFB, Texas
- Aircraft Propeller Mechanic
- Contract Construction Inspector
- Reciprocating Aircraft Maintenance Specialist
- Outside Wire and Antenna Repairman
- Accounting and Finance Officer
  - Sheppard Technical Training Center, Texas
- E-3A Avionics Instrument Specialist
- E-3A Electrical System Specialist
  - Field Training Detachment 413, Tinker AFB, Oklahoma
- E-3A Weapons Director
- E-3A Airborne Computer/Display Maintenance Technician
  - 552 AWAC Wing, Tinker AFB, Oklahoma
- AQM-34M Missile Systems Maintenance Specialist
  - Field Training Detachment 512, Davis-Monthan AFB, Arizona
- A-10 Pilot
  - 4444 Operations Squadron (TAC), Davis-Monthan AFB, Arizona
- H-53 Combat Rescue Aircrew
  - 1550 Aircrew Training and Test Wing (MAC), Kirtland AFB, New Mexico

STEPS OF PROCESS

Need/Discrepancy Analysis

ISD originates with the identification of a need to develop or revise instruction. Instruction must be developed if the human performance elements of a new job or weapon system require training. Instruction must be revised if existing training is not sufficiently effective and economical. Prerequisite conditions for determining need are the existence and maintenance of procedures for detecting indications of potential discrepancies. When a potential discrepancy is identified, additional information is gathered as needed for further confirmation and definition of the problem, and to suggest the appropriate locus for corrective action—that is, where the ISD process should begin, and the extent of ISD that is appropriate to the problem.

Table 11

Need/Discrepancy Analysis:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable[a]/ Not Determined
1. Information is available about possible discrepancies between training and field requirements.	31	2	24
Procedures	**Done**	**Not Done**	**Not Applicable[b]/ Not Determined**
1. Analyze initial and supplementary information.	24	22	11
2. Identify and specify discrepancy.	23	23	11
3. Specify ISD entry point and boundaries of redesign process.	19	27	11

[a]Not Applicable prerequisites occur in instances where their status is moot (e.g., prerequisite states the location in ISD process where step is to occur, but step has not been performed).

[b]Not Applicable procedures occur in ISD efforts that were examined in progress and for which a given step was not yet appropriate.

In about one-third of the courses studied, it was found that training development had been initiated in response to an identified training deficiency, and that the entry point for ISD had been specified accordingly. In most cases, however, the deficiency was simply the lack of any training program for some newly introduced equipment or a new job specialty. Only five of the development efforts (9%) had been undertaken in response to indications of poor training or job performance, such as failed inspections or high attrition. In 11 courses, it could not be determined whether the identification of a training deficiency had led to the requirement to redesign existing training. Training developers interviewed did not always know what circumstances preceded their own efforts.

The low incidence of cases in which specific training deficiencies were identified and remedied through the ISD process may be partly due to the manner of selecting the sample of courses for this study. Courses which had reportedly undergone many ISD steps were selected over those which had undergone only a few, and training developers on site were asked to describe their "most complete" ISD efforts. Both of these factors would tend to favor the selection of training design efforts which had begun with front-end analysis, rather than those for which a later ISD entry point had been specified.

Identification of Job Requirements

Job analysis consists of three parts: compiling a provisional list of tasks believed to comprise the job; verifying the accuracy of the list and adjusting it as necessary; and gathering task priority information. Task lists are developed in a two-phase process to increase their reliability. The initial list may be generated in various ways, ranging from the recollections of a single subject matter expert to extensive observation of job incumbents. Verification may also take different forms, ranging from review by a second group of subject matter experts to a phone or much broader mail survey. Ideally, verification includes validation with a representative sample of job incumbents.

Task priority information is data about such factors as billets where the task is performed, percent of persons performing, and frequency of performance. To increase the reliability of what are inevitably subjective estimates, this information should usually be gathered from a fairly large sample of job incumbents.

Table 12

Identification of Job Requirements: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
None			
Procedures	**Done**	**Not Done**	**Not Applicable Not Determined**
1. Construct provisional task list.	38	13	6
2. Verify and revise on basis of review/ survey of job incumbents.	27	20	10
3. Collect task priority information.	24	23	10

A provisional task list was constructed in 38 of the courses studied, and in 27 of those cases it was subjected to some kind of verification by job incumbents or other subject matter experts. In the Army most of the lists were constructed by personnel permanently assigned to task analysis duties at TRADOC schools, as in a Directorate of Training Developments. In the Marine Corps the lists were generally constructed by resident school instructors temporarily assigned to course development duties, sometimes as members of an *ad hoc* Course Content Review Board. In the Navy the list was likely to be an occupational survey (NOTAP) printout, or an existing list of watch-standing or equipment maintenance duties. When a Navy task list was constructed specifically for course development, this was usually done, in the case of technical training, by instructors under the coordination of a Curriculum and Instructional Standards Office, or, for air crew training, by former incumbents temporarily assigned to work with an ISD contractor. Most Air Force task lists were CODAP printouts. When a list was constructed by Air Force course developers, which occurred only rarely in non-flying training, it was compiled by instructors.

The principal instances in which job task lists were not compiled were a few field-conducted, equipment-specific courses in the Navy and a variety of Air Force courses

for which no occupational survey report was available. Of the development efforts examined, those in the Air Force had the highest (50%) of cases in which task lists were definitely not compiled. It may be that the wide availability of CODAP printouts leads Air Force training designers to consider task list construction solely the responsibility of occupational measurement personnel. The procedure specified in Air Force Pamphlet 50-58, however, is to use occupational survey data along with other information to build a complete task list arranged by job duties. This approach was rarely taken in Air Force technical training. If a CODAP printout had been obtained, the development of a Course or Specialty Training Standard (selection of tasks for training) was generally reported as the next ISD step accomplished.

If either a NOTAP or a CODAP printout was available and reported to be used, it was considered a verified task list for the purposes of this study. However, personnel interviewed often questioned the usefulness of these occupational survey reports, on the grounds that the task descriptions were not suitable for deriving training objectives. As the recommended AFP 50-58 procedure implies, perhaps such lists are not adequate by themselves to serve as the basis for training development. Examination of some of the NOTAP/CODAP lists used to develop courses in this study revealed that some items listed were well-defined task descriptions, while others were actually general skills or non-task categories of behavior.

Selection of Tasks for Training

Tasks identified by job analysis are classified into those to be trained and those not to be trained. Tasks selected form the basis of the training program; those rejected are not reconsidered until the final external evaluation. Prerequisites for task selection are a list of tasks which comprise the job, information for establishing their importance and need for training, and decision rules for determining training priorities. To promote objectivity, this information and the procedures for processing it should be developed prior to the selection process. After identifying which tasks are desirable to train, and which tasks are most important, requirements for training resources are considered. Final selection is made on the basis of training resource requirements and availability—that is, cost. A factor which greatly influences cost is the training setting, but to avoid bias in task selection the setting is selected separately, insofar as possible.

Table 13

Selection of Tasks for Training:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Tasks performed in the job are listed.	38	13	6
2. Information is available for establishing importance of tasks and need for training.	23	23	11
3. Decision rules to be applied to task information are available.	7	40	10
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Apply decision rules to information for each task to determine training priorities.	5	41	11
2. Select tasks for training on basis of training priorities and resource availability.	6	40	11

Although a job task list of some kind was available in 38 of the courses studied, information for establishing task importance was available in only 23, and decision rules for selecting tasks for training were applied to this information in only five. Moreover, such decision rules as were followed were rudimentary at best. In one case, the rule of thumb was to train any task which at least 5% of incumbents performed; in another it was 30%; in a third, it was tasks judged critical to mission accomplishment. In a fourth instance, tasks were generally chosen if performed by 60% or more of incumbents, or if critical or difficult.

Overall, the selection of tasks for training in the four Services was not characterized by deliberate determination of task selection criteria and the subsequent selection of tasks on the basis of task priority information. When priority information was collected, it was rarely employed in any systematic fashion. When training designers reported that such information was used in selecting tasks, it was common to find that it had been furnished by the same subject matter experts who were making the task selection, and

at the same time. Even when the effort was made to collect task priority information from job incumbents independently, respondents were often asked to indicate the criticality, difficulty, frequency, and so forth of a task and at the same time whether it should be trained—thus confounding job analysis with task selection, and losing the advantages in objectivity of keeping the activities separate. Under these conditions, one task might be selected for its frequency, and another for its difficulty. Applying the same criteria to all tasks, or certain criteria to particular classes of tasks, rarely, if ever, occurred. Tasks were seldom ranked in importance to allow the most efficient allocation of available training resources or to aid in determining what those resources should be. Thus, any potential of the ISD approach for determining training resource requirements according to task importance was not generally being realized.

Aside from the absence of decision rules, other practices tended to make task selection less than systematic. Often, the original job task list was not maintained in readily usable form. Once tasks were selected, it was difficult to determine where they had come from. In other cases, task selection began before job analysis was complete, or was substituted for it altogether. This may have been due to a natural reluctance to expend effort delineating tasks felt to be unimportant, or to management emphasis on records of tasks selected for training (e.g., Training Standards, Soldier's Manuals) rather than job task inventories.

Records showing which job tasks had been selected and which rejected were seldom available, and records showing why a given task had been selected, hardly ever. Tasks were commonly combined, subdivided, or otherwise altered in the process of going from job requirements to training requirements, especially when the task list was an occupational survey report. Often the only evidence of which tasks had been selected was a set of training objectives, each of which might cover several tasks, or only part of one. In the absence of records to the contrary, it is possible that the tasks "selected" for training in a given course were the only tasks considered—that is, selection would not have occurred.

In the Army, tasks were selected by personnel assigned to job analysis duties in the Directorate of Training Developments at a TRADOC school, who were responsible for developing Soldier's Manuals. After tasks had been selected for this purpose, the same task lists were forwarded to other directorates or divisions within the school to serve as the basis for TEC lessons, Skill Qualification Tests, resident training, and other training elements. It was found that the selection of tasks made by those responsible for job analysis was not always accepted and used by those to whom it was forwarded. This was especially likely to happen in the development of resident courses, where in some instances the activities conducted at the "front end" of the ISD process had little or no connection with what was taught in the classroom. This situation was not universal across the six Army schools visited, but it was typical.

It should be noted that the Army is currently emphasizing training and evaluation products for use in operational units, rather than in schools (Soldier's Manuals, TEC lessons, SQTs, etc.). With respect to resident training, more emphasis is being given to changing training methods than to determining content. ISD activities were being applied to resident training primarily when courses were being converted to self-pacing.

Since task selection in the Army is performed at the school which is proponent for doctrine in a particular MOS, command approval is inherent in the selection process. In the Navy, Marine Corps, and Air Force, tasks selected for training (usually in the form of training objectives) are typically sent to a higher command for approval. In the Navy and Air Force, where training developed at one site may be conducted at others as well, and graduates of a course may be assigned to different commands, it is common to

seek the concurrence of the other units or commands involved. In the Air Force, a training review conference ("scrubdown") is sometimes convened, bringing representatives of receiving commands together with representatives of the school where initial training is developed and implemented.

Efforts to obtain agreement on training content represent an apparent departure from ISD methodology, which suggests the use of rigorous decision rules, rather than the achievement of consensus. Personal judgment may, however, be the only means for task selection now available. As noted in Chapter 2, there are currently no known criteria of total system effectiveness by which to determine task selection criteria. Perhaps the almost universal failure of training designers to select tasks systematically according to predetermined criteria is in recognition of how arbitrary any set of task selection rules must be. Even when given a mathematical formula to apply to available information, as in Air Force Pamphlet 50-58, no one reported using it.

In the absence of decision rules for task selection, there may nevertheless be some value in requiring task priority information to be collected by survey, or even "developed" when tasks are selected. The mere availability of such information may make the personal judgment of training designers more informed, and the requirement to justify task selection on some grounds may make the selection more thoughtful.

Analysis of Tasks

Task analysis is a description of when and how, within the job environment, performance of a task is required. It consists of a specification of conditions of performance and initiating cues, behavioral elements, and standards of performance. Information generated during task analysis is used later in constructing Job Performance Measures and developing objectives. The prerequisite for task analysis is the identification of tasks to be analyzed.

Table 14

Analysis of Tasks:
Incidence of Prerequisites and Procedures in Course Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Tasks selected for training are listed.	41	10	6
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. For each task specify for the job environment:			
– Conditions of performance.	16	29	12
– Behavioral elements.	31	13	13
– Standards of performance.	19	28	10

In the 41 training design efforts in which tasks were identified for training, behavioral elements were identified in about three-fourths (31 courses), while task conditions and standards were identified in less than half. The greater incidence of identification of behavioral elements was partly due to their being listed in training objectives or instructional materials. The Army and Marines account, proportionally, for nearly all explicit task analysis. In the Army, task conditions, elements, and standards are listed in the Soldier's Manual; in the Marine Corps they were found in task analysis worksheets. In the Navy and Air Force, the identification of task conditions and standards as distinct from training conditions and standards was infrequent. The approach generally followed was to specify conditions only as required for course control documents, without first having determined the standards and conditions of job performance. Two of the four instances of explicit task analysis found in the Navy were large-scale ISD efforts at the Instructional Program Development Center, San Diego.

Construction of Job Performance Measures

Job Performance Measures may be constructed for each task that has been selected for training to serve as a means both of keeping training faithful to job requirements and of evaluating training and the design process. To maintain fidelity to job requirements, training objectives can be derived directly from Job Performance Measures. To evaluate training design, Job Performance Measures are administered to persons in training, or after they have reached the job. To serve their purposes, Job Performance Measures must be constructed before objectives or achievement tests are developed. Not all models of ISD include the construction of Job Performance Measures.

Table 15

Construction of Job Performance Measures: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Tasks selected for training are listed.	12	2	43
2. Training requirements for these tasks have not been identified.	8	6	43
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Construct a test for measuring the performance of each task selected for training.	11	36	10
2. Validate each Job Performance Measure to insure that it predicts task performance.	3	38	16

Job Performance Measures were developed in 11 courses, and validated or verified in three. In all cases but one, however, these measures were simply performance-oriented achievement tests constructed for within-course use. In only one instance, IPDC San Diego, were JPMs constructed and at least partially validated in the field, in accordance with the ITRO model procedures. No other case was found in which training designers constructed task measures early in the training design process to serve as a means of evaluating subsequent course design and implementation. Training designers reported in some cases that they did not have sufficient resources to attempt to construct or validate JPMs; the IPDC itself discontinued the attempt after its first course development effort, citing the considerable time and expense required. The remainder of the courses that were classified in this study as using JPMs generally incorporated exercises performed on actual equipment or full-scale training devices—maintenance simulators, mock warehouse, aircraft, and so forth.

Selection of Setting

Every task that has been selected for training must be assigned to a particular location and situation in which training will occur. A prerequisite to carrying out this step is the freedom to assign tasks to any of several settings. Another is the availability of information about the costs of training in the alternative settings. This step involves an interface with other components of the operational system, beyond the training subsystem. To assign tasks to different settings in such a way as to maximize total system effectiveness requires knowledge of how alternative assignment patterns would affect the total system.

Table 16

Selection of Setting:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Tasks can be assigned to any of several settings.	18	23	16
2. Information is available on costs of training in different settings.	0	0	57
3. Information is available on effects of training in different settings on total system effectiveness.	0	0	57
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Assign each task or group of tasks to its appropriate setting.	16	37	4

In only 18 courses were training designers free to assign tasks to any of several settings. Usually they were concerned only with the setting in which they themselves were located and for which they were developing training. In the Marine Corps no instances were found in which training designers assigned tasks to other than resident schools, and in both the Navy and the Air Force this occurred in only about one-third of the applicable courses. Although training developers in the Army were free to assign tasks to different settings in three out of four applicable cases, in one of these the procedure was simply to assign every task to a resident school unless it was impractical to teach it there.

In almost all cases, setting selection was actually synonymous with task selection; personnel selecting tasks for training were almost always selecting them for one particular setting. The statement in the AFP 50-58 model that course developers would seldom be in a position to designate training settings (see p. 32) was found to be closer to actual practice than the situation depicted by the ITRO model, in which designers are free to develop job performance aids or on-the-job training as alternatives to school training. An exception to the general case was the practice in some Navy training design efforts of designating "A" School, "C" School, formal on-the-job training, or other setting for each job task. Since personnel interviewed were cognizant only of how training had been developed for their own setting, it was not determined whether training was actually developed for these other settings as well.

Development of Training Objectives and Objectives Hierarchies

Training objectives are descriptions of what a trainee is expected to be able to do following instruction. Their development represents a shift in the ISD process from the job to training. Developing objectives involves serveral steps:

- Deciding how closely capabilities for task performance at the conclusion of training shall match the requirements of the job.
- Specifying dependent and coordinate relationships within tasks (terminal objectives), among subtasks (intermediate objectives), and mediating skills and knowledge (intermediate objectives).
- Deciding, based on estimates of the abilities of entering trainees, what terminal objectives must actually be developed during training, and what knowledge and basic skills must be provided to mediate learning and performance.

Table 17

Development of Training Objectives and Objectives Hierarchies: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Tasks selected for training are listed.	44	7	6
2. Information is available about training constraints that make it necessary to modify task requirements.	0	0	57
3. Information is available about how modification of task requirements will affect training efficiency.	0	0	57
4. Estimates of capabilities of entering trainees for learning and performing each task are available.	5	2	50
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Specify task requirements (behaviors, conditions, standards) for training.	51	1	5
2. Perform hierarchical analysis of tasks to identify intermediate training objectives.	14	39	4

Training objectives were developed in nearly all cases (51 courses). The use of behavioral objectives to describe training content is thus the single most unifying characteristic of the courses studied. In some cases, the very purpose of course revision was to add properly worded objectives (e.g., observable, measurable) to course control documents.

The relationship of objectives to job tasks, however, varied considerably. In several cases objectives were developed in the absence of any specification of a set of tasks

selected for training. In the remaining cases it was common for one objective to represent several tasks, or vice versa, or both. In Navy and Air Force technical training this was standard practice, with a single objective sometimes being listed as pertaining to a dozen or more different tasks. It was often unclear what rules, if any, had governed the derivation of objectives from a single task, or the representation of so many tasks by one or several objectives. In many cases personnel interviewed did not report the use of any systematic procedure. Thus, although there were often records showing which objectives went with which tasks, there is reason to question whether the objectives had actually been derived from the tasks.

In only one-fourth of the courses studied was there an effort to develop a hierarchy to derive objectives. In the great majority of cases, no systematic attempt was made to analyze tasks or other objectives to determine what must be learned in order to master them. Moreover, in the cases in which some hierarchical analysis was judged to have occurred, an actual outline or diagram of the relationship of objectives to tasks or other objectives was usually absent. Rarely had trainers deliberately estimated the capabilities of entering trainees in order to determine the limits of hierarchical analysis.

The ISD process is partly a means of insuring that training will not exist for its own sake, but that mastery of training requirements will lead to successful job performance. The ISD procedure of deriving terminal training objectives directly from tasks, and intermediate or enabling objectives in turn, is intended to preserve this close relationship. In practice, this one-to-one correspondence between job tasks and terminal objectives was the exception rather than the rule. Although there is nothing inherently unsystematic about deriving several objectives from the same task, or combining similar tasks, the typical lack of any corresponding methodology for doing so suggests that objectives were often matched to tasks after training content was already known, rather than as the means of determining that content.

It appears that in many cases—perhaps the typical case—objectives had been written to "cover" subject matter currently taught or being added to a course. Under this condition, training objectives would have been from training content, rather than content from objectives. Further support for this conclusion, in addition to the fact that personnel interviewed often could not specify the derivation process, is the fact that objectives often were written simultaneously with instruction and by the same persons. In at least one instance, the objectives said to be based on job analysis were incorporated without any changes in what was taught.

Job conditions were specified in only 16 of the courses studied, and job standards in 19, compared to the 51 courses for which objectives were written. Training conditions and standards, then, were usually specified in the absence of explicit job conditions and standards. As mentioned, this practice was found more frequently in the Navy and Air Force. Its consequences may be trivial, if training designers are aware of job standards and conditions and develop objectives accordingly. Just as easily, however, it could lead to establishing training standards that are unnecessarily high, or so low that training is inadequate—the very conditions that the systems approach is designed to avoid.

To the extent that objectives are developed along with instruction, as they often were, the strong possibility arises that training standards will simply be written to reflect training content. As the data show, it was not determined how much training designers knew about the extent of changes in job standards or conditions, or how such changes might affect training effectiveness. In the absence of specified job standards or conditions, of course, the questions are moot. When task analysis had been accomplished, some personnel interviewed were aware that their training standards differed from job standards, but no one reported any knowledge of the possible effects of the change.

Development of Achievement Tests

Objective-referenced achievement tests are used to determine the capabilities of the entry population, to determine the effectiveness of training, and to diagnose student performance during training. A particular requirement of ISD is that tests be developed directly from objectives, rather than from the content of lessons, to insure that they measure the mastery of job objectives, not merely training content.

Table 18

Development of Achievement Tests: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Training objectives have been specified.	50	0	7
2. Instructional materials have not been developed.	16	31	10
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Determine appropriate types of tests based on characteristics of objectives.	0	6	51
2. Construct tests to assess attainment of objectives.	27	18	12

In 27 cases, tests were constructed to measure every terminal objective, and in the other cases testing was generally extensive. A widespread practice was the use of criterion-referenced testing in place of norm-referenced testing, a conversion that was often mandated by Service directive. "Criterion-referenced" generally meant that scoring methods such as the following were employed: setting a relatively high percentage of correct responses for passing a knowledge test; setting a low limit of permissible errors (often zero) on performance tests; scoring each unit of a test on an "all or none" basis; and requiring trainees to pass all tests, retaking them as required.

Since Service policies discourage high failure rates from schools, the selection of criteria obviously involves considering the norm—what the trainees can be expected to learn in a reasonable time. For tests to be strictly criterion-referenced, the criteria for satisfactory performance would be wholly determined by job requirements, and training would be increased as necessary to meet the criteria. In the courses studied, these conditions did not prevail.

The most significant finding with regard to ISD application is that tests were constructed before instructional materials in only one-third of the applicable cases. Thus, there was usually no independent criterion by which to determine whether mastering the course subject matter was related to mastering the course objectives. This applied especially to knowledge tests, which were hardly ever reported as having been based directly on training objectives (the objectives themselves often simply stated the

requirement to pass a written test), thus leaving to those who developed lesson plans or other instruction the actual determination of what the trainee must learn.

It was not determined in each case whether test developers had considered what types of tests or test items would be appropriate to measure the objectives. Many trainers reported that objectives were classified as either performance of knowledge, and that tests were developed accordingly. Only in rare cases, however, did personnel report they used a finer classification of objectives in developing test items (e.g., whether "behaviors" are skilled or unskilled, whether "knowledge" requires the application of concepts or rules or the recall of facts).

Identification of Entry Behavior

When tests have been developed, earlier estimates of trainee entry behavior can be verified. The derivation of objectives had been based on these estimates. Since trainees are not generally available at this time, a determination of entry behavior is made by measuring performance of a group that is representative of the entry population in aptitude, experience, previous training, and other relevant attributes.

Table 19

Identification of Entry Behavior:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Objectives have been derived through hierarchical analysis of tasks.	11	38	8
2. Tests are available to measure objectives.	45	0	12
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Identify sample that is representative of trainees.	0	49	8
2. Administer tests to sample, and determine accuracy of earlier estimate of entry behavior.	0	49	8
3. Add or delete objectives as indicated by test results, and repeat cycle.	0	49	8

Although objective-referenced achievement tests were available in many cases, and hierarchical analysis had been used to some extent in developing objectives, no one reported using tests to verify the estimates or assumptions about trainee entry behavior underlying the objectives. Unless estimates were always accurate, training requirements were either overestimated or underestimated. If trainee capabilities were overestimated, the discrepancy should appear during validation of instruction. If trainee entry behavior had been underestimated, however, the resultant "overtraining" would not necessarily be revealed by any later ISD step.

Classification of Objectives and Selection of Instructional Activities

Objectives are classified according to the type of capability they represent, and specific activities necessary to provide for learning are identified. In later steps, media will be chosen and instructional materials developed to support these activities.

Table 20

Classification of Objectives and Selection of Instructional Activities: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Information is available about types of instructional activities appropriate to acquiring different types of capabilities.	0	0	57
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Classify each objective or group of objectives according to type of capability.	8	40	9
2. Specify instructional activities for each objective according to type of capability.	1	48	8

In only one case were instructional activities reported to be specified in accordance with a distinct classification of behaviors required in objectives (e.g., recall information, perform gross motor movement, apply a rule, display an attitude). In some other cases, objectives were classified in broad categories such as motor skill or knowledge. In none of these cases, however, were instructional activities specified in accordance with the classification.

In a few instances, general instructional activities were suggested to lesson plan writers, such as the use of a visual aid or the opportunity for trainees to practice. Such suggestions, however, were not reported as being based on an analysis or classification of the characteristics of the objectives.

As stated in Chapter 2, the current state-of-the-art of instructional technology does not provide a basis for a full procedure for specifying instructional activities, or even for classifying objectives. Also, the AFP 50-58 guidance on this subject appears to be addressed only to persons who will author instruction, not those writing lesson specifications. If so, it would partly explain the absence of such specifications in Air Force ISD efforts.

This does not explain the almost universal failure of training designers to carry out this step in the other Services, whose ISD models clearly recommend that instructional activities be specified. No general explanation emerged from interviews with the training designers; the step appeared rather to have been ignored. Possible explanations include the novelty of the step; the lack of a requirement to produce documents showing that it was carried out; incomplete understanding of what was meant by an instructional activity; and reluctance to assume a function that has formerly been the prerogative of instructors who develop lessons.

Selection of Instructional Methods

After instructional activities have been specified, instructional methods are selected. These are the ways in which trainees will be brought into contact with the instruction. Methods are selected to maximize the effectiveness and efficiency of instruction, given the particular instructional activities, the nature of the trainee population, the setting, and administrative requirements and constraints.

Table 21

Selection of Instructional Methods: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Setting has been specified.	52	0	5
2. Trainee characteristics have been identified.	0	1	56
3. Instructional activities have been specified.	1	49	7
4. Information is available on how the costs and effectiveness of alternate methods vary for specified settings, trainee characteristics, and instructional activities.	0	3	54
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Specify the methods of instruction to be employed for each objective or group of objectives.	51	0	6

The determination of type of pacing, group size, control of instruction, and other instructional choices is inherent in implementing any training program. Thus Table 21 shows that methods were specified in all applicable courses (52). There was little evidence, however, that the choice was made on the basis of the characteristics of the trainees or the instructional activities, or with the knowledge of what effects alternate methods would have on training effectiveness or cost. In the typical case, it was reported that no systematic procedure was used to select methods. Either changing existing methods had not been considered or the option to do so did not rest with the personnel interviewed.

In a significant number of training design efforts, however, a change in methods had been directed, and was the stated object of the course revision. The most common change was the conversion of courses to self-pacing and individualization of instruction, notably in the Army, and in Navy and Air Force flying training. Conversion to computer management of instruction is another example. In both types of cases, the decision was apparently made by higher command that a particular method offered advantages that were general enough to apply to all training covered by the directive. The basis on which the decision was made was not determined.

Selection of Media

After instructional activities and training methods have been specified, and before instructional materials are developed, media are selected that will provide an effective and efficient means for presenting the subject matter to the trainee. Media which satisfy the requirements of the learning activities and methods are first identified, and then costs determine the final selection.

Table 22

Selection of Media:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Training designers are free to select from a range of media.	6	9	42
2. Instructional activities have been specified.	4	45	8
3. Methods of training have been specified.	39	1	17
4. Information is available concerning the appropriateness of different media to implement different activities and to be used in conjunction with different methods.	0	0	57
5. Information is available concerning the costs of different media.	0	0	57
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Determine which media will be suitable to implement the instructional activities and methods.	3	47	7
2. Consider relative costs of media determined above and select most economical set of media.	1	48	8

The ISD procedure of identifying media appropriate to the instructional methods and the stimuli inherent in the instructional activities was hardly ever followed. Instructional activities had been identified in only four courses. A systematic attempt to identify media appropriate to particular objectives was made in only three cases, and the attempt to consider costs and select the most efficient set of media occurred in only one instance.

Training developers indicated that in general this step, like the selection of instructional methods, had simply not been attempted. Again, either no consideration was given to changing existing media, or training designers were not at liberty to do so. Where personnel interviewed were aware that this was an ISD step they had not carried out, the cost of converting to a different medium was typically cited as a limitation on their design options.

Analogous to the selection of methods, converting to a new medium was sometimes the primary reason for revising a course. In such a case media selection occurred before any of the other ISD steps. Such conversions were typically undertaken to facilitate a change to individualized instruction.

As noted in Chapter 2, the current state of instructional technology does not permit the prediction of which medium will be most effective in training for a given objective. The algorithms provided in the various ISD manuals are not sufficient by themselves to allow a training designer to identify the most efficient medium, even if cost information were available and the stimulus requirements of instructional activities could be identified in every instance. Whether training designers perceived the inadequacy of the procedural aids is not clear. In any event, no attempt to use them was reported.

Grouping and Sequencing of Instruction

Objectives are grouped and sequenced acco ding to dependency and commonality of subject matter, and transfer and efficiency oi learning. Decisions are also subject to practical and administrative considerations. A principal characteristic of ISD is that decisions about sequencing and grouping be made on the basis of learning factors as much as possible, rather than solely on the basis of administrative factors or past practice.

Table 23

Grouping and Sequencing of Instruction: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Knowledge of the effects on learning of different sequencing plans is available.	1	52	4
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Identify commonality of subject matter and anticipated transfer of learning between objectives.	7	39	11
2. Identify degree of dependency between objectives.	13	29	15
3. Select overall sequencing principle(s).	13	32	12
4. Group and sequence objectives.	51	0	6

As with selection of methods, a determination of sequence is inherent in any training program, and Table 23 shows accordingly that this was accomplished in all applicable cases. However, a systematic attempt to base the sequence of instruction on the degree of commonality, dependency, or learning transfer among objectives was reported in only six cases. It may be significant that two of these six cases were Navy flying training courses developed by civilian contractors. Although commonality or dependency was identified in some other cases as well, there was no evidence that these relationships among objectives had been used to determine the most effective instructional sequence.

In the typical case, no consideration was given to how alternate sequencing strategies would affect learning. In many cases the schedule of equipment and facilities availability was cited as the controlling factor in sequencing. In other cases, it was reported that the proper sequence was obvious or had followed "logical" order, which generally meant providing instruction on one system or piece of equipment at a time, beginning with theory of operation or other general information and proceeding to specific information or practice. If an existing course was revised, changing the existing sequence was usually not considered.

Next to equipment and facilities availability, dependency is perhaps the most readily apparent sequencing consideration. Factors such as transfer of learning are harder to estimate, and, as noted in Chapter 2, principles of sequencing are ambiguous. It may be that training developers did not consider that a systematic procedure was necessary to discover what was dependent, and that any attempt to consider other factors offered little promise.

Development of Plan for Authoring and Managing Instruction

A plan is prepared to guide those who will author, conduct, and manage the instructional program. Whether in a single master plan or in separate documents intended for the different personnel concerned, the decisions and specifications made in previous ISD steps are transmitted to those who will carry them out. Decisions about administrative matters such as class schedules and equipment use are included.

Table 24

Development of Plan for Authoring and Managing Instruction: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Objectives, instructional activities, methods, and media have all been specified.	5	44	8
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Specify the content and design of each lesson.	31	15	11
2. Specify how the instruction will be conducted and managed.	50	1	6

In 31 courses, the design and content of each lesson were specified in a plan of some kind. The extent to which such plans had been developed prior to authoring instruction and had guided lesson authors could not be determined. Generally, there was little evidence that they had. A typical plan was a Program of Instruction or Curriculum Outline listing lessons, objectives, number of hours for training, equipment required, etc.

While objectives, instructional methods, and media were available in nearly all cases in which plans had been prepared, instructional activities had been identified in less than 10% of all courses examined. Thus, the extent to which specific activities were included in authoring plans was necessarily quite limited. The plans available in the courses studied appeared to be intended more to record the content and control the conduct of training than to provide design specifications for lesson authors. In virtually all cases, plans included information about how instruction would be conducted and managed (e.g., group or self-paced, instructor or computer managed).

Review and Selection of Existing Materials

After instructional activities and media have been specified, any available existing instructional materials are examined to see if they match these specifications in whole or in part. Materials that match can be used, with resultant savings in the authoring of instruction. In addition to satisfying established specifications for instructional activities, methods, and media, materials adopted must also be appropriate to trainee characteristics and the instructional management plan of the proposed course.

Table 25

Review and Selection of Existing Materials: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Instructional activities have been specified.	5	43	9
2. Methods of training have been specified.	49	0	8
3. Media have been specified.	37	7	13
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Examine existing instructional materials to determine whether any meet the specifications for instructional activities, methods, and media.	10	36	11
2. Select materials or parts of materials that meet the specifications, or which could be efficiently revised.	11	35	11

Existing materials were reviewed and selected in 10 courses. In most cases, the materials under review were simply those of the course being revised. Instructional materials from other Services or the civilian sector were reviewed in only a few instances.

Characteristics of the planned instruction, such as methods, media, and instructional activities, rarely provided the basis for the review and selection process. (Methods and media specifications were available in most of the applicable cases, but instructional activities in only five.) Rather, the typical method was to inspect materials on the basis of general suitability to the new or revised course.

Authoring of Instruction

The content of instruction is determined by earlier decisions with respect to grouping and sequencing of objectives, instructional activities, methods, media, and the specification of content for individual units/lessons in the authoring plan. The actual authoring process consists of preparing scripts, texts, tape/slide programs, etc. As first drafts of instructional materials are produced, small portions are tried out on individuals who are representative of the entry population. Materials are then revised to correct weaknesses, omissions, and ambiguities. A distinguishing characteristic of ISD is initially to include only the bare minimum of instruction and subsequently to augment instruction as needed.

Table 26

Authoring of Instruction:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Objectives have been grouped and sequenced.	49	0	8
2. Instructional activities have been specified.	5	42	10
3. Methods of training have been specified.	48	0	9
4. Media have been specified.	37	8	12
5. Lesson structure and content have been planned.	30	14	13
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Develop lean instruction.	11	28	18
2. Try out instruction on small number of persons representative of students.	10	31	16
3. Revise and augment instruction as necessary.	5	30	22

As indicated in Table 26, the sequence and methods of instruction were nearly always determined prior to authoring materials, while the choice of media was occasionally left to lesson authors. By contrast, instructional activities were specified only about 10% of the time. A plan for lesson authors was available in about two-thirds of the cases.

In only 11 courses was there an attempt to restrict the content of instruction to the minimum necessary. Most interviewees were not familiar with this concept. Although other ISD steps were often reported to have been omitted due to constraints of time or money, lack of awareness appears to be the important factor with respect to developing lean instruction. Anyone who reported an awareness of the advantages of keeping instruction lean also reported trying to do so. By contrast, some interviewees reported that they had done just the opposite—with no apparent awareness that their approach was contrary to the general intent of ISD.

Nine of the 11 cases of lean instruction were found in the Navy. These include both courses developed by ISD contractors for the Naval Training Equipment Center, and both courses developed by the Instructional Program Development Center, San Diego—presumably reflecting a greater awareness of the requirements and purpose of ISD among those permanently engaged in course design. Except in these cases, the virtual restriction to the Navy of efforts to keep instruction lean is unexplained.

The development of lean instruction was found, not surprisingly, to be associated with efforts to try out and revise instruction, and with the subsequent ISD step of attempting to validate it. Although instructional materials were tried out and revised in only five cases, three of the five represent instances where there was an attempt to provide lean instruction. Instruction was validated in less than one-fourth of the total applicable courses, but was valided in two-thirds of the instances of lean instruction. The association of tryout, revision, and validation with lean instructional development is quite reasonable since the practice of restricting instructional content to a minimum requires the use of some parallel procedure to measure instructional adequacy.

Validation of Instruction

Instruction is tried out under conditions that closely approximate its intended use, with groups of trainees representative of the entry population. Objective-referenced achievement tests are the primary validation criterion.

Table 27

Validation of Instruction: Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Objective-referenced achievement tests are available.	47	0	10
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Specify achievement test validation criteria (number and percent of persons in validation sample required to pass tests).	7	30	20
2. Specify additional validation criteria.	4	32	21
3. Present instruction, administer achievement tests, analyze results, revise instruction, and repeat cycle until validation criteria are met.	9	31	17

Although objective-referenced achievement tests were available in every case, instructional materials were subjected to a validation process in only nine courses. Even in two of these nine cases, no criteria of adequacy were established for the validation trials. Seven of the nine validation efforts occurred in the Navy, including—as in the case of developing lean instruction—both courses at IPDC San Diego and a contractor-developed course for NTEC (the other NTEC-sponsored contractor effort had not reached the point of validation at the time of the interview).

For many courses, no self-teaching materials (tape/slide, text, etc.) were being produced—only lesson plans to guide instructors' presentations. In such cases, the validation process would require repeated presentation of the lesson under controlled conditions. No one, however, reported following such a procedure; there were no efforts to validate lesson plans.

Interviewees at Army schools reported that the TEC lessons being produced to support individual training are subjected to a validation process. No TEC lessons were reported to be used in the courses studied, and consequently no TEC development efforts were reviewed, but at least one instance of such validation was briefly observed.

Internal Evaluation

Internal evaluation determines how well instruction works during actual training with actual trainees. Validation occurs only once, while internal evaluation is continuous. The principal measure is trainee performance on objective-referenced achievement tests. Analysis or evaluation of how the ISD process itself was carried out is also part of internal evaluation, and is sometimes termed process evaluation.

Table 28

Internal Evaluation:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Records of students' performance on achievement tests are available.	28	1	28
2. Documentation is available of what occurred during the ISD process, including rationales for decisions, departures from standard procedures, etc.	13	19	25
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Specify evaluation criteria (number and percent of persons required to pass tests, etc.).	4	28	25
2. Identify the causes of shortcomings in the instruction and specify revisions.	15	18	24

Efforts to investigate shortcomings in ongoing instruction and recommend remedies were reported in 15 courses. Such efforts rarely involved comparing trainee performance to a standard of course adequacy; despite the almost universal availability of achievement test scores, a criterion of course adequacy was established in only four cases. Possibly trainers see little need for such standards in light of established limits on course attrition. If a requirement for course completion is to achieve every objective, for example, and if permissible course attrition rates are determined by higher command, it may be felt that no other standards are necessary.

Some documentation of the ISD process itself was available in 13 courses. The comprehensiveness of such documentation varied greatly. In some cases records were available showing when different activities had been started and completed, but in most instances documentation was less detailed. Notably absent from nearly all documentation were rationales for the selection of tasks, setting, methods, and media.

External Evaluation

Trainee proficiency and the adequacy of the instructional design process are determined by using a standard external to the course: the performance of the graduate on the job. The most accurate methods of external evaluation are direct observation and testing of graduates. Reliance, however, must usually be placed on supervisors' summary evaluations (ratings) of performance. Evaluation information of whatever type should be obtained at a task level of specificity. More general evaluations are of little use in isolating the causes of inadequate performance.

Table 29

External Evaluation:
Incidence of Prerequisites and Procedures in Courses Examined (N=57)

Prerequisites	Present	Absent	Not Applicable/ Not Determined
1. Access to supervisors and job incumbents is available soon after arrival of graduates on the job.	24	1	32
Procedures	**Done**	**Not Done**	**Not Applicable/ Not Determined**
1. Construct evaluation instruments (mail questionnaires, job sample tests, interview guides, etc.).	19	15	23
2. Collect evaluation information.	16	15	26
3. Analyze data, identify causes of deficiencies, and specify revisions.	8	17	32

Information about graduates' performance in the field was collected in 16 courses. In half of these cases, the information was analyzed and used in making some revision in the course. Questionnaires to graduates and supervisors—usually, but not always, written at the task level—were the main method employed. In one instance a pre-existing Job Performance Measure was used.

In most of these cases the persons responsible for course development also planned and conducted the external evaluation. In two courses, the Training Evaluation Division of an Air Force technical training school conducted the evaluation and issued a formal Training Evaluation Report. Formal evaluations of the same kind were conducted for some Army courses as well, by the school Directorate of Evaluation. Although no external evaluations had been completed for any of the Army courses studied, two were scheduled to begin in the near future.

In many of the cases in which graduates' opinions or information about their performance was collected, however, the effort did not appear to have a clear connection with the instructional design/revision process. Some interviewees reported that data collected from graduates or supervisors had never been made available to those who had designed the course. In other cases periodic surveys were conducted, as directives required, but with no apparent idea of how the survey responses would be used to determine the need to revise instruction. In general, whether personnel could perform on the job the tasks for which they had been trained was not determined. The ISD "closed loop" remained open.

SUMMATION

The great majority of ISD steps are either rarely undertaken in the Services or are carried out in a manner which fails to meet the requirements of ISD. Application of ISD in any real sense is virtually restricted to five steps: Identification of Job Requirements, Analysis of Tasks, Development of Objectives and Objectives Hierarchies, Development of Achievement Tests, and External Evaluation. These are all steps for which procedures are available, and which do not involve considerations of total system performance or training subsystem efficiency.

The execution of even these steps, however, often falls short of achieving the intent and purpose of ISD. Job requirements are often defined simultaneously with, rather than prior to, the determination of training requirements, thus inviting training considerations to influence job analysis; the means by which job requirements then become training requirements are generally not explicit. Task analysis does not usually include the delineation of task conditions and standards, on which the derivation of training conditions and standards would logically depend. Objectives are as likely to be developed from instructional content, as content from objectives; objectives hierarchies *per se* are rarely developed, with the result that necessary basic skills and knowledge are usually not incorporated in training design specifications. Tests are often derived from instructional content rather than directly from objectives, raising the possibility that such tests may fail to measure attainment of the actual objectives. Information collected about graduates' job performance is seldom used to revise training.

The potential of ISD to insure that training meets job requirements depends both upon (a) maintaining the interdependency of steps in a derivative process originating in description of the job itself, and (b) testing and revising the products of each of these steps until they meet previously identified requirements. In practice, however, the necessary close connection between steps is generally not maintained, nor is the cycle of testing and revision carried through.

The principal effect of the current emphasis on ISD appears to be an awareness of contemporary training methods and techniques. The use of behavioral objectives to describe training content and the specification of criteria of mastery for training objectives is almost universal; and there is widespread awareness of the desirability of restricting training to what is needed for job performance. Although the ISD cycle of evaluation and revision is hardly ever carried through successive iterations, there is widespread acceptance of the principle that trainees' performance is the valid measure of training effectiveness. Although instructional activities, sequence, methods, and media are still determined by *ad hoc* personal judgment rather than systematic procedures, the conversion of traditional group-paced training to individualized self-paced instruction, and the replacement of the lecture or tutorial with other media, are common occurrences in ISD efforts.

Chapter 6

FINDINGS AND RECOMMENDATIONS

The present study sought answers to these questions:

- Do current methodologies as represented in guidance documents provide the means for attaining the goals of Instructional System Development?
- Do applications of ISD reflect these goals?
- How can ISD methodologies and applications be made more effective?

The basic information for answering these questions was sought by analyzing guidance for 19 individual steps of ISD in four Service Models, and the manner in which each step was carried out in 57 course design efforts. This approach yielded findings about methodologies (Chapter 2) and their applications (Chapters 4 and 5) specific to particular steps, as well as more general findings about the system. In this chapter findings and accompanying recommendations for specific steps are presented first. They are followed by a discussion of the general adequacy of ISD and recommendations for its future implementation.

FINDINGS AND RECOMMENDATIONS FOR SPECIFIC ISD STEPS

Need/Discrepancy Analysis

Findings

1. Methodology - Present ISD models do not include procedures for identifying problems in existing training and for identifying a need to undertake ISD. Guidance is needed on how to identify discrepancies between existing training and the field requirements for a job, and how to revise training short of undertaking the entire ISD process.
2. Application - ISD is not generally initiated in response to specific discrepancies between training and field requirements.
3. Application - ISD is usually initiated in response to a directed change (e.g., provide individualized and self-paced instruction) or to a requirement to revise existing training in accordance with ISD methods.

Recommendations

1. Where existing training is being examined, ISD methodologies should emphasize evaluating and improving the training, rather than simply assuming that development of a new course is appropriate. At present new courses are rarely evaluated any more rigorously than the ones they replace.
2. To increase the emphasis on evaluation and improvement, specific procedures should be developed both to identify faults in existing training and to determine efficient boundaries for the ISD process.

IDENTIFICATION OF JOB REQUIREMENTS

Findings

1. Methodology - Current guidance for identifying job requirements permits considerable latitude in the approach taken and the level of description used, with resulting variation in the reliability and utility of the information developed.

2. Application - Job analysis is usually confounded with the selection of tasks for training. Emphasis is not given to independently specifying requirements *as they exist in the job.*

3. Application - Job task lists from occupational surveys (e.g., CODAP, NOTAP) are sometimes available. The information provided by such lists, however, is often in part about classes of activities rather than about tasks, and to that extent may not serve as an adequate base for deriving training. Often, complete task lists are not developed.

Recommendation

1. Training developers should be required to provide and maintain a description of job task requirements distinct from a listing of tasks selected for training. This would make explicit the extent to which training requirements differ from job requirements.

Selection of Tasks for Training

Findings

1. Methodology - There are no measures of system effectiveness that can be used to validate criteria for selecting tasks for training, and rules for applying such criteria. As a result, the choice of criteria to be used in selecting tasks to be trained is left to personal judgment.

2. Application - Selecting tasks for training is generally not preceded by a separate and distinct delineation of the tasks required by the job.

3. Application - Task selection for training is usually not done systematically. Its rationale is rarely explicit.

4. Application - Task priorities (that would provide the basis for getting the maximum training benefits from the available funding) are not specified.

Recommendations

1. Training developers should be required to make explicit the basis on which they select tasks for training, and to specify priorities among both the tasks selected and the tasks rejected for training for a particular job.

2. In the absence of information about the effects of task selection criteria on system performance, guidance should be developed on the types of task priority information likely to be relevant for different classes of jobs.

Analysis of Tasks

Findings

1. Methodology - Procedures for analyzing tasks are adequate.
2. Application - Job task conditions and standards, as distinct from *training* conditions and standards, are seldom identified. Course control documents do not require that job characteristics be specified.

Recommendation

1. Benefits of attempting to modify current practices do not appear great relative to costs. No change in present practice is recommended.

Construction of Job Performance Measures

Findings

1. Methodology - Procedures for developing JPMs are adequate in the ITRO model, unclear in the Marine Corps model, and not included in the AFP 50-58 model.
2. Application - JPMs have been developed in jobs where the consequences of inadequate performance are especially serious, such as in flight training or use of special weapons.
3. Application - In only one instance were JPMs developed as part of ISD to validate within-course tests.

Recommendation

1. While theoretically worthwhile, JPMs are costly to develop. It is unrealistic to recommend their development except in special instances. No change in present practice is recommended.

Selection of Setting

Findings

1. Methodology - A systematic procedure for determining the optimal setting for training does not exist. The development of such a procedure waits upon a means for measuring system performance, which in turn will permit the validation of site selection criteria and decision rules.
2. Application - In general, training developers do not have the authority to designate and develop training in different settings.

Recommendation

1. The choice of training setting has effects on the operational system beyond the training subsystem. It is appropriate that the setting selection be made at a higher level than training developer. In the absence of a means for assessing total system effectiveness, no change in present practice is recommended.

Development of Training Objectives and Objectives Hierarchies

Findings

1. Methodology - The ITRO model provides the most comprehensive, explicit, and straightforward procedures for translating job requirements into training objectives. Deficiencies in the Marine Corps model could encourage writing objectives to match what is being taught, rather than to meet job requirements.
2. Application - The specification of training objectives is virtually universal, but the procedures used to identify objectives are highly variable and frequently unclear. There is evidence that objectives are often prepared after the fact and are derived from training content rather than used to generate it.
3. Application - Terminal objectives are seldom subjected to an explicit hierarchical analysis to derive intermediate objectives. A determination of the skills and knowledge that would enable the trainee to meet the terminal objectives would emerge from such an analysis; these often are not identified.
4. Application - Even where records are maintained, formats for displaying the relation between tasks and training objectives make it hard to determine what objectives have been derived from a given task. That is, tasks that represent objectives are displayed, rather than objectives that have been derived from each task. Thus, the justification for training for specific objectives is often not clear.

Recommendation

1. The derivation of training objectives from job tasks should be made explicit in a format that cross-references objectives *by task*.

Development of Achievement Tests

Findings

1. Methodology - All of the models require that achievement tests be developed from training objectives, rather than from the content of lessons, and all provide some information about test construction. All models lack procedures for maintaining congruence between the behaviors implied in an objective and the actual requirements imposed by test items (e.g., use performance tests to measure skilled behavior; require that concepts be applied when an objective implies their use rather than their recall or recognition).
2. Application - Many achievement tests are derived, not directly from training objectives, but from training content. Knowledge tests are particularly likely to be derived from content. In these cases, no independent criterion exists to determine whether training objectives have been met.
3. Application - In general, little or no consideration is given to matching the type and level of test items to the behavioral requirements of objectives (see Finding 1).

Recommendations

1. ISD models should explain and emphasize the purpose and need for deriving achievement tests from training objectives rather than from training content.
2. ISD models should be expanded to provide procedures for identifying and maintaining congruence between the behavioral requirements of objectives and test items.

Identification of Entry Behavior

Findings

1. Methodology - The major ISD models provide procedures for adjusting training objectives to match trainee capabilities.
2. Application - Estimates of capabilities of trainee populations are not verified by testing before the training is implemented.

Recommendation

1. The advantages of correcting inaccurate estimates of trainee capabilities do not appear to justify the costs of the measurement that would be required. Overestimates are likely to be identified during the validation of instruction, and underestimates usually become evident during the conduct of instruction. No change in present practice is recommended unless large investments in instructional materials are involved (e.g., Training Extension Course (TEC) development).

Classification of Objectives and Selection of Instructional Activities

Findings

1. Methodology - Procedures for classifying training objectives, and for selecting instructional activities accordingly, are not highly developed. Different models use different taxonomies for classifying objectives, and guidance for both classifying objectives and selecting instructional activities is provided largely by example rather than by means of explicit decision rules.
2. Application - Training objectives generally are not classified, and instructional activities generally are not specified.

Recommendation

1. Explicit decision rules for classifying objectives and selecting instructional activities should be developed. In the absence of such rules, no change in present practice is recommended.

Selection of Instructional Methods

Findings

1. Methodology - All models describe and discuss alternative instructional methods. They specify prerequisite conditions (e.g., setting, group size) for the use of particular methods but provide little information about the relative effectiveness of different methods, either for particular types of content or for trainee populations. Though perhaps sufficient to allow the training developer to reject inappropriate methods, the information base and the models themselves are not sufficient to provide for selecting optimal methods.

2. Application - Training methods are not systematically selected either on the basis of instructional activities (which are also not specified) or on the basis of trainee characteristics.

3. Application - Changes in training methods are almost always in response to command policy.

Recommendation

1. Present training technology is not advanced enough to support proceduralized derivation of training methods from previously specified instructional activities and trainee characteristics. Information about optimal training methods for different training situations, and procedures to enable developers to identify the most promising methods, should be developed. In the absence of such procedures, no change in present practice is recommended.

Selection of Media

Findings

1. Methodology - Procedures for selecting training media appear adequate to match the presentation (stimulus and response) requirements of instructional activities to appropriate media, if instructional activities have been specified in sufficient detail.

2. Application - Training media are not systematically selected on the basis of requirements of instructional activities (which are also not specified).

3. Application - Developers generally do not have freedom to select among alternative media. Choices and changes in media are usually directed by command policy.

Recommendation

1. Selection of appropriate media is contingent on how well instructional activities have been specified. No change in the current models for matching media to activities is appropriate until activities are more widely specified, and these models can be tested.

Grouping and Sequencing of Instruction

Findings

1. Methodology - Universal principles for grouping and sequencing instructional objectives do not exist, other than that dependent objectives be placed later than those on which they depend. Alternate theories and conflicting strategies abound, with no knowledge base for resolving them. Because systematically related principles for promoting learning are lacking, sequencing instruction must be left to the individual judgment of the training developers.

2. Application - Practices in grouping and sequencing instruction generally give no consideration to learning requirements other than the order imposed by obvious dependencies. Attention is given to constraints of non-learning factors such as equipment availability and scheduling.

Recommendation

1. Organized and systematically related principles of learning on which to base grouping and sequencing decisions are not available. The development of such information falls within the psychology of learning and is beyond the scope of recommendations in this report. In the absence of such information, no change in present practices is recommended.

Development of Plan for Authoring and Managing Instruction

Findings

1. Methodology - All models require the preparation of a plan for authoring and managing instruction.
2. Application - Plans that record course content are often prepared.
3. Application - Plans typically do not specify instructional events and are rarely used to develop instructional materials.

Recommendation

1. Explicit decision rules for selecting instructional activities do not presently exist (see Classification of Objectives and Selection of Instructional Activities above). Until such rules are available and generally acknowledged as valid, a requirement to specify instructional activities in an authoring and managing plan is likely to be viewed as a pointless exercise. No change in present practice is recommended.

Review and Selection of Existing Materials

Findings

1. Methodology - The ITRO and Marine Corps models state that decisions to use existing materials (rather than author new instruction) are to be based on the appropriateness of these materials to the previously specified characteristics of objectives, methods, and media. The AFP 50-58 model does not provide guidance for reviewing and selecting existing material.
2. Application - Characteristics to be identified in judging the appropriateness of existing training materials are not specified.
3. Application - Review and use of existing training materials is minimal, except for those in a course that is being revised.

Recommendation

1. The specification of necessary properties of materials for particular training situations, and the description and cataloging of existing materials to permit the interchange of matching components across courses, represent a degree of perfection

that is not presently attainable. An attempt to reduce the review and selection of existing materials to a systematic procedure is to act as if the methods of a well-developed technology were available in an area in which judgment is in fact the dominant factor. No change in present practice is recommended.

Authoring of Instruction

Findings

1. Methodology - All models specify that instructional materials undergo tryout during the authoring process. The ITRO and Marine Corps models emphasize that instruction should be lean to insure the economies of minimal instruction.
2. Application - There is little awareness of the concept of lean instruction, and few attempts to develop it.
3. Application - Instruction is rarely given tryout and revision during authoring.

Recommendation

1. Training managers should receive guidance on the purpose and importance of developing lean instruction. Guidance should indicate the role of tryout and revision of instruction as a necessary element of this strategy.

Validation of Instruction

Findings

1. Methodology - All models specify satisfactory procedures for validating instruction. The adequacy of training materials for attaining objectives is verified through the administration of achievement tests.
2. Application - Validation criteria—that is, evidence that instruction is satisfactory—are rarely specified.
3. Application - Instruction is rarely validated before it is implemented. When validation does occur, it is training materials (e.g., textbooks, tape/slide programs) that are evaluated; instructor lessons and lesson plans are almost never evaluated.

Recommendation

1. Of the three major types of ISD evaluation (validation, internal evaluation, external evaluation), validation has the greatest potential for effecting improvements in instruction. Once instructional materials have been produced and instruction has been implemented, changes are less likely to be introduced, and new materials are more difficult to generate. Validation trials to meet specified criteria should be required before new instruction is approved.

Internal Evaluation

Findings

1. Methodology - All models specify adequate procedures for the internal evaluation of training. Quality control of the training product is to be maintained through the administration of objective-referenced achievement tests.
2. Application - Evaluation and revision of instruction based on needs revealed in student performance (product evaluation) are generally not done.
3. Application - Training design decisions are rarely documented (process evaluation), to facilitate redesign when instruction is found to be inadequate.

Recommendation

1. Trainers should be required to determine and record trainee performance for each objective. Although absolute standards to identify when training revision is needed are difficult to establish, the recording of specific trainee performance would provide a desirable prerequisite to any revision. Moreover, it would suggest relative standards for the need to revise training.

External Evaluation

Findings

1. Methodology - the ITRO model prescribes the most reliable and most costly way to measure the adequacy of the instructional design process: administering Job Performance Measures to graduates in the field. It also provides the most guidance for isolating causes of performance discrepancies after the external evaluation of training. If summary evaluations are to be used, the ITRO and AFP 50-58 models specify that information be obtained at the task level of specificity, while the Marine Corps model does not.
2. Methodology - None of the models specify criteria that should be used to determine whether training is to be revised as a result of external evaluation, nor how to arrive at such criteria. None tell how good job performance must be to indicate that training is acceptable.
3. Application - The effectiveness of training is virtually never evaluated by the administration of Job Performance Measures to job incumbents.
4. Application - Supervisor summary evaluations of job incumbent performance are occasionally obtained but usually are not provided at a task or training objective level of specificity. Even when performance and job requirements information is obtained, it is rarely used to redesign training.

Recommendations

1. The high cost of administering performance tests to job incumbents and the difficulty of maintaining the necessary degree of objectivity and standardization preclude their widespread use to evaluate training. No change in present practice is recommended.

2. Training can be evaluated by gathering information (rather than direct measurement) about job performance and job requirements, at a task and training objective level of specificity, far more thoroughly than is presently done. The failure to obtain and use such information is a major shortcoming in current applications of ISD. While decision rules for using such information cannot at present be based on measures of total system effectiveness, other means for arriving at such criteria are available. It is recommended that *operational commands* define both the specificity of the task description and the level of performance they would be willing to use to evaluate the acceptability of job incumbents. These are the criteria that supervisors should use to judge (rate) field performance and establish the need for training revision.

GENERAL FINDINGS AND RECOMMENDATIONS

Judgments about the adequacy of Instructional System Development, its representation in the Service models, and the way it is currently being applied depend on one's conception of what ISD is and what it is expected to accomplish.

The most general way to define ISD is as a *means of designing training to optimize total system effectiveness.* Criteria do not exist for measuring total system effectiveness; ISD is not being used to achieve, nor can it be expected to result in, optimizing the effectiveness of the total system.

A more circumscribed view of ISD is as a *methodology for maximizing training efficiency within the training subsystem.* However, information about the effectiveness and costs of different training strategies is far from complete, and a trial-and-error approach to maximizing efficiency is not practical, given the number of possible combinations of methods. While ISD does provide a framework for comparing alternative training strategies, it is not currently being used, nor can it be regarded, as a methodology for maximizing training efficiency.

A more highly focused view is that ISD is a *methodology for insuring that training is relevant to the job.* Its iterative and derivative character virtually assures that training will be relevant if available procedures are faithfully carried out. In practice, however, many of its components are omitted, and the close connection between components that is essential to make the process truly derivative is not maintained. Most important, the testing and revision necessary to insure job relevance generally do not occur. The potential of ISD to insure that training meets job requirements is not being realized.

A final conception of ISD is that it is synonymous with the *use of modern training technology.* Any of the steps in the training development process are a part of modern training technology, and so are any of those particular training and evaluation methods currently being emphasized (e.g., self-paced instruction, computer-managed instruction, criterion-referenced testing). This definition of ISD is clearly the least demanding, since in essence it holds that undertaking any training development step or using any such training or evaluation method constitutes ISD. It is the definition that is most adequately represented in current applications of ISD.

In summary, then, two effects of ISD are currently possible: *insuring that training meets job requirements* and *promoting the use of modern training technology.* The former, which is clearly the more desirable, is not being achieved. The ISD modes does provide the methodology for making training relevant, but the mere existence of the model does not compel trainers to follow it. Trainers are relatively free, within fairly broad limits,

to determine the extent to which they will conform to the ISD process and actually use its products in designing training. For example, front-end analysis may be undertaken, but its results can be and frequently are ignored. Training objectives often are developed with indifference to, or in ignorance of, actual task requirements. Many tests and instructional materials are developed without regard to training objectives. Information about the performance of trainees, once collected, is often not used to revise training, and feedback about graduates, if initiated, is often not acted upon.

Because ISD is a process, it is difficult to observe directly. The occurrence of a process is generally inferred from the presence or absence of its products. In the case of ISD, however, the mere existence of its products—job task lists, training objectives, achievement tests, and the like—does not by itself indicate that they have been used in training development. Considerable evidence that many ISD products remain unused leads to the conclusion that, while the generation of these products can be mandated, the ISD *process* and the appropriate use of the products during training development cannot.

Similarly, a routine allocation of responsibilities in ISD does not necessarily guarantee that these responsibilities will be recognized, accepted, and carried out. For example, ISD methodology requires developers to specify the way in which proficiency will be developed or mediated for all job tasks—immediately, through entry training; later, through advanced training or job experience; or through direct support of job performance by procedural aids or other means. Yet this requirement is frequently ignored. ISD is generally conducted to develop training for only one particular setting, and the manner in which skill will be acquired for tasks that are <u>not</u> selected for training in that setting is usually not specified. Even where skills were explicitly identified for later acquisition, the present study found little evidence either that means were developed for subsequent training or that operational units were informed of their responsibilities for insuring that these skills be acquired. (This observation is based on training development within the training subsystem. The present study did not examine training developed or conducted in operational units. Possibly such an examination would indicate that training for job skills in these units is being conducted in a more comprehensive manner than was suggested by the evidence in the present study.)

The current failure of ISD applications to insure that training meets job requirements, then, is largely due not to inadequacies in the methodology, but to omissions and to failure to use its products in a way that makes the process truly derivative. An implication of these findings is that future efforts to implement ISD should concentrate on finding ways to maintain the integrity of the model.

The findings of the study do not of themselves indicate how to assure rigorous adherence to what is clearly a very demanding model, but they do suggest that introducing changes solely within the training subsystem is not likely to have any great effect. The data strongly suggest the need for checks and balances to guard against omissions in the ISD process and failures to use the ISD products. It would appear logical, therefore, to provide for an expanded role by operational commands—the party directly affected by shortcomings in training, and best able to assess the effects of training.

Such an expanded role for operational commands is, in fact, implied by the model itself. The derivative and iterative aspects of ISD depend on feedback and exchange of information between trainers and users. It is difficult to see how ISD could be more rigorously applied unless such an exchange takes place. In principle, the training subsystem seeks information about field requirements and performance as the foundation on which training is constructed. In practice, however, the study found that the training subsystem does not have this basic orientation, often giving insufficient attention to the

effective use of this information. It is reasonable to suggest that a balanced relationship—one that fosters active participation by, and communication between, operational and training commands—is essential to the ISD process.

The following recommendations define the means by which operational commands can assume a greater role. Under these recommendations, operational commands would participate to the greatest extent in those parts of ISD where job performance is represented and where job performance requirements are translated into training requirements. Those parts of ISD concerned with the design of instructional strategies to meet training and job requirements would remain the province of the training community.

It is recommended:

(1) *That job requirements* (skills and knowledge required for successful job performance) *be jointly defined, and agreed to, by training and operational commands.* This recommendation is a prerequisite to Recommendation 2, and to all subsequent training development activities. If successful dialogue, negotiation, and agreement are to follow, training requirements must be based on a mutually agreed-upon definition of job requirements.

(2) *That training requirements* (skills and knowledge to be available at the conclusion of training) *be jointly defined, and agreed to, by training and operational commands.* Such an agreement should identify the specific tasks and standards to which proficiency will be developed, and should delineate the respective responsibilities of the two parties. This includes providing a means for bringing job incumbents to the desired level of proficiency whenever agreed-upon training requirements do not match job requirements.

(3) *That operational commands be required to evaluate the performance of training graduates, and report their findings to the training commands.* Unless operational commands evaluate performance, feedback from users to trainers will not have a sound basis. Without reliable information about the effects of training, specification of training requirements will not serve its purpose.

(4) To implement Recommendation 3, *that task-specific criteria for evaluating the performance of graduates, including methods and standards to be employed, be jointly defined, and agreed to, by training and operational commands.* Evaluation criteria should be at the task level of specificity to permit clear and useful diagnosis of training. More general evaluations are of little use in isolating the causes of inadequate performance. Evaluation criteria must be jointly agreed to if the results of evaluations are to be accepted as valid, and acted upon.

Giving the operational commands a greater role in both establishing training requirements and determining whether requirements have been met will not of itself guarantee that ISD procedures will be rigorously applied to the development of training. It will, however, increase the involvement of those who have the most fundamental interest in seeing that training has been adequately designed and conducted.

So long as training development and evaluation are regarded as a separate activity of the training commands, there is little reason to expect that ISD will be applied any more effectively than under the present conditions. If training and operational commands share these activities—each making its specialized contribution to complement the work of the other—the potential of the ISD process for improving training will be enhanced.

Appendix A

ISD ACTIVITIES QUESTIONNAIRE
(MAIL SURVEY INSTRUMENT)

ISD ACTIVITIES QUESTIONNAIRE

You are being asked to complete this questionnaire to provide information about courses/training programs where Instructional System Development (ISD) procedures have been applied. This information will be used in the first phase of a study of ISD in the Armed Forces. In a later phase, visits will be made to selected installations to obtain more detailed information.

In addition to identifying problems that have arisen in applying ISD, the study seeks to identify those factors associated with both successful and unsuccessful applications. This information will be used to determine what organizational and other support is required for ISD implementation.

Instructions for Completing the Questionnaire

1. Enter identification information below.

   Organization: _____
   (Command or School or Unit)

   Address: _____

   _____

   Person to be contacted for additional information: _____

   Commercial phone: _____

2. Enter below the total number of courses/training programs administered by the above organization. For the purpose of this questionnaire, "courses/training programs" include any course or program of instruction, training, or education.

   Total number conducted at the school or unit: _____

   Total number conducted by correspondence or extension: _____

3. On the following page, list the titles of all courses/training programs for which job analysis data (task lists) have been compiled and are currently available. Although this questionnaire does not require ISD to be defined in terms of any particular set or sequence of actions, it does require that a list of job tasks be available. Therefore, list only courses/training programs for which task lists are available.

4. For each course/training program that has been listed, provide information about ISD activities by completing columns 2-22 on the following pages.

Human Resources Research Organization
(Contract 903-77-C-033)

Office of Assistant Secretary of Defense
(Manpower, Reserve Affairs, & Logistics)

Instructions for Completing Columns 1 - 23

Column 1: Enter Courses/Training Programs for which job analysis data (task lists) are available.

Column 2: Enter N if the job analysis data were/are being used to develop a new course.
Enter E if the job analysis data were/are being used to evaluate/revise an existing course.
Enter O if the job analysis data were/are being used for other purposes than course development or revision.

Column 3: *If a course was/is being developed or revised, enter the approximate date when the first graduates reached/will reach the job.*

Columns 4 - 22: Provide information about ISD activities
Enter A if . . . the activity was undertaken, and documentation or products are available.
Enter P if . . . the activity was attempted, but products are not available due to methodology *or other problems.*
Enter N/C if . . . the activity is being undertaken, but is not completed.
Enter N/A if . . . the activity is not applicable or was not undertaken.

1 COURSES/ TRAINING PROGRAMS FOR WHICH JOB ANALYSIS DATA ARE AVAILABLE	2 Approximate Date when first graduates reached (or will reach) the job.	3 N = New Course E = Existing Course O = Other Purpose(s)	4 Analyzed problem/system/existing course to determine need for training development.	5 Obtained priority information about tasks (frequency, delay tolerance, criticality, etc.)	6 Analyzed tasks into elements, conditions, and *standards.*	7 Selected tasks for training on the basis of task priority information.	8 Clustered tasks and selected instructional setting on the basis of priority information, resources, and output requirements.	9 Developed terminal and intermediate *learning objectives.*	10 Sequenced and clustered objectives.

11	12	13	14	15	16	17	18	19	20	21	22	23
												Developed, tried out, and revised tests.
												Revised training according to results of external evaluation.
											Determined if graduates were meeting performance requirements on the job (external/field evaluation).	
										Revised training according to results of internal evaluation.		
									Analyzed student performance (for internal evaluation of course).			
								Conducted instruction.				
							Validated instruction materials.					
						Authored/produced new instruction materials.						
					Reviewed/selected appropriate existing instruction materials.							
				Specified plan for pacing, instructor role, group/individualized presentation, scheduling, entry/exit requirements, etc.								
			Identified media appropriate to type of learning and learning activities.									
		Identified type(s) of learning required for each objective, and specified corresponding learning activities.										
	Identified knowledge and skills of entering trainees.											

Turn page to list additional courses.

Appendix B

INCIDENCE BY SERVICE OF PREREQUISITES AND PROCEDURES IN COURSES EXAMINED

Appendix B

Incidence by Service of Prerequisites and Procedures in Courses Examined[1]

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Need/Discrepancy Analysis				
Prerequisites				
1. Information is available about possible discrepancies between training and field requirements.	Army	2	0	5
	Navy	11	1	11
	Marine Corps	2	0	5
	Air Force	16	1	3
Procedures				
1. Analyze initial and supplementary information.	Army	2	5	0
	Navy	10	10	3
	Marine Corps	2	2	3
	Air Force	10	5	5
2. Identify and specify discrepancy.	Army	2	5	0
	Navy	9	11	3
	Marine Corps	1	2	4
	Air Force	11	5	4
3. Specify ISD entry point and boundaries of redesign process.	Army	1	6	0
	Navy	8	12	3
	Marine Corps	1	3	3
	Air Force	9	6	5
Identification of Job Requirements				
Prerequisites				
None				
Procedures				
1. Construct provisional task list.	Army	7	0	0
	Navy	16	4	3
	Marine Corps	6	0	1
	Air Force	9	9	2

(Continued)

[1] Total number of courses examined in each Service: Army–7; Navy–23; Marine Corps–7; Air Force–20.

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Identification of Job Requirements *(Continued)*				
2. Verify and revise on basis of review/survey of job incumbents.	Army	6	1	0
	Navy	11	8	4
	Marine Corps	4	1	2
	Air Force	6	10	4
3. Collect task priority information.	Army	5	1	1
	Navy	7	12	4
	Marine Corps	4	0	3
	Air Force	8	10	2
Selection of Tasks for Training				
Prerequisites				
1. Tasks performed in the job are listed.	Army	7	0	0
	Navy	15	4	4
	Marine Corps	7	0	0
	Air Force	9	9	2
2. Information is available for establishing importance of tasks and need for training.	Army	5	2	0
	Navy	7	11	5
	Marine Corps	2	1	4
	Air Force	9	9	2
3. Decision rules to be applied to task information are available.	Army	3	4	0
	Navy	2	17	4
	Marine Corps	1	2	4
	Air Force	1	17	2
Procedures				
1. Apply decision rules to information for each task to determine training priorities.	Army	2	5	0
	Navy	1	18	4
	Marine Corps	1	1	5
	Air Force	1	17	2
2. Select tasks for training on basis of training priorities and resource availability.	Army	2	5	0
	Navy	2	17	4
	Marine Corps	1	1	5
	Air Force	1	17	2

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Analysis of Tasks				
Prerequisites				
1. Tasks selected for training are listed.	Army	7	0	0
	Navy	16	15	2
	Marine Corps	3	2	2
	Air Force	15	3	2
Procedures				
1. For each task specify for the job environment:				
– Conditions of performance.	Army	7	0	0
	Navy	3	15	5
	Marine Corps	4	0	3
	Air Force	2	14	4
– Behavioral elements.	Army	6	0	1
	Navy	9	9	5
	Marine Corps	4	0	3
	Air Force	12	4	4
– Standards of performance.	Army	7	0	0
	Navy	5	14	4
	Marine Corps	4	0	3
	Air Force	3	14	3
Construction of Job Performance Measures				
Prerequisites				
1. Tasks selected for training are listed.	Army	4	0	3
	Navy	3	1	19
	Marine Corps	1	0	6
	Air Force	4	1	15
2. Training requirements for these tasks have not been identified.	Army	3	1	3
	Navy	2	2	19
	Marine Corps	1	0	6
	Air Force	2	3	15
Procedures				
1. Construct a test for measuring the performance of each task selected for training.	Army	4	3	0
	Navy	2	17	4
	Marine Corps	0	4	3
	Air Force	5	12	3

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Construction of Job Performance Measures *(Continued)*				
2. Validate each Job Performance Measure to insure that it predicts task performance.	Army	0	4	3
	Navy	2	17	4
	Marine Corps	0	5	2
	Air Force	1	12	7
Selection of Setting				
Prerequisites				
1. Tasks can be assigned to any of several settings.	Army	4	0	3
	Navy	8	10	5
	Marine Corps	0	2	5
	Air Force	6	11	3
2. Information is available on costs of training in different settings.	Army	0	0	7
	Navy	0	1	22
	Marine Corps	0	0	7
	Air Force	0	2	18
3. Information is available on effects of training in different settings on total system effectiveness.	Army	0	0	7
	Navy	0	1	22
	Marine Corps	0	0	7
	Air Force	0	2	18
Procedures				
1. Assign each task or group of tasks to its appropriate setting.	Army	3	4	0
	Navy	7	15	1
	Marine Corps	0	6	1
	Air Force	6	12	2
Development of Training Objectives and Objectives Hierarchies				
Prerequisites				
1. Tasks selected for training are listed.	Army	7	0	0
	Navy	17	4	2
	Marine Corps	5	0	2
	Air Force	15	3	2
2. Information is available about training constraints that make it necessary to modify task requirements.	Army	0	0	7
	Navy	0	0	23
	Marine Corps	0	0	7
	Air Force	0	0	20

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Development of Training Objectives and Objectives Hierarchies *(Continued)*				
3. Information is available about how modification of task requirements will affect training efficiency.	Army	0	0	7
	Navy	0	0	23
	Marine Corps	0	0	7
	Air Force	0	0	20
4. Estimates of capabilities of entering trainees for learning and performing each task are available.	Army	0	0	7
	Navy	5	2	16
	Marine Corps	0	0	7
	Air Force	0	0	20
Procedures				
1. Specify task requirements (behaviors, conditions, standards) for training.	Army	6	0	1
	Navy	22	0	1
	Marine Corps	5	1	1
	Air Force	18	0	2
2. Perform hierarchical analysis of tasks to identify intermediate training objectives.	Army	3	3	1
	Navy	7	16	0
	Marine Corps	3	3	1
	Air Force	1	17	2
Development of Achievement Tests				
Prerequisites				
1. Training objectives have been specified.	Army	6	0	1
	Navy	21	0	2
	Marine Corps	[illegible]	0	2
	Air Force	18	0	2
2. Instructional materials have not been developed.	Army	3	3	1
	Navy	8	12	3
	Marine Corps	2	1	4
	Air Force	3	15	2
Procedures				
1. Determine appropriate types of tests based on characteristics of objectives.	Army	0	3	4
	Navy	0	1	22
	Marine Corps	0	2	5
	Air Force	0	0	20
2. Construct tests to assess attainment of objectives.	Army	6	0	1
	Navy	0	18	5
	Marine Corps	4	0	3
	Air Force	17	0	3

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Identification of Entry Behavior				
Prerequisites				
1. Objectives have been derived through hierarchical analysis of tasks.	Army	3	3	1
	Navy	5	15	3
	Marine Corps	2	4	1
	Air Force	1	16	3
2. Tests are available to measure objectives.	Army	6	0	1
	Navy	19	0	4
	Marine Corps	3	0	4
	Air Force	17	0	3
Procedures				
1. Identify sample that is representative of trainees.	Army	0	6	1
	Navy	0	20	3
	Marine Corps	0	6	1
	Air Force	0	17	3
2. Administer tests to sample, and determine accuracy of earlier estimate of entry behavior.	Army	0	6	1
	Navy	0	20	3
	Marine Corps	0	6	1
	Air Force	0	17	3
3. Add or delete objectives as indicated by test results, and repeat cycle.	Army	0	6	1
	Navy	0	20	3
	Marine Corps	0	6	1
	Air Force	0	17	3
Classification of Objectives and Selection of Instructional Activities				
Prerequisites				
1. Information is available about types of instructional activities appropriate to acquiring different types of capabilities.	Army	0	0	7
	Navy	0	0	23
	Marine Corps	0	0	7
	Air Force	0	0	20
Procedures				
1. Classify each objective or group of objectives according to type of capability.	Army	2	3	2
	Navy	4	16	3
	Marine Corps	0	5	2
	Air Force	2	16	2
2. Specify instructional activities for each objective according to type of capability.	Army	0	6	1
	Navy	1	19	3
	Marine Corps	0	5	2
	Air Force	0	18	2

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Selection of Instructional Methods				
Prerequisites				
1. Setting has been specified.	Army	6	0	1
	Navy	22	0	1
	Marine Corps	6	0	1
	Air Force	18	0	2
2. Trainee characteristics have been identified.	Army	0	0	7
	Navy	0	1	22
	Marine Corps	0	0	7
	Air Force	0	0	20
3. Instructional activities have been specified.	Army	0	6	1
	Navy	1	20	2
	Marine Corps	0	5	2
	Air Force	0	18	2
4. Information is available on how the costs and effectiveness of alternate methods vary for specified settings, trainee characteristics, and instructional activities.	Army	0	0	7
	Navy	0	1	22
	Marine Corps	0	0	7
	Air Force	0	2	18
Procedures				
1. Specify the methods of instruction to be employed for each objective or group of objectives.	Army	6	0	1
	Navy	22	0	1
	Marine Corps	5	0	2
	Air Force	18	0	2
Selection of Media				
Prerequisites				
1. Training designers are free to select from a range of media.	Army	0	1	6
	Navy	3	5	15
	Marine Corps	0	0	7
	Air Force	3	3	14
2. Instructional activities have been specified.	Army	0	6	1
	Navy	4	16	3
	Marine Corps	0	5	2
	Air Force	0	18	2
3. Methods of training have been specified.	Army	3	0	4
	Navy	18	1	4
	Marine Corps	0	0	7
	Air Force	18	0	2

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Selection of Media *(Continued)*				
4. Information is available concerning the appropriateness of different media to implement different activities and to be used in conjunction with different methods.	Army	0	0	7
	Navy	0	0	23
	Marine Corps	0	0	7
	Air Force	0	0	20
5. Information is available concerning the costs of different media.	Army	0	0	7
	Navy	0	0	23
	Marine Corps	0	0	7
	Air Force	0	0	20
Procedures				
1. Determine which media will be suitable to implement the instructional activities.	Army	1	5	1
	Navy	2	19	2
	Marine Corps	0	5	2
	Air Force	0	18	2
2. Consider relative costs of media determined above and select most economical set of media.	Army	0	6	1
	Navy	1	19	3
	Marine Corps	0	5	2
	Air Force	0	18	2
Grouping and Sequencing of Instruction				
Prerequisites				
1. Knowledge of the effects on learning of different sequencing plans is available.	Army	0	6	1
	Navy	0	22	1
	Marine Corps	0	6	1
	Air Force	1	18	1
Procedures				
1. Identify commonality of subject matter and anticipated transfer of learning between objectives.	Army	1	5	1
	Navy	3	16	4
	Marine Corps	0	4	3
	Air Force	3	14	3
2. Identify degree of dependency between objectives.	Army	2	4	1
	Navy	5	13	5
	Marine Corps	1	3	3
	Air Force	5	9	6
3. Select overall sequencing principle(s).	Army	2	4	1
	Navy	3	16	4
	Marine Corps	2	2	3
	Air Force	6	10	4

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Grouping and Sequencing of Instruction *(Continued)*				
4. Group and sequence objectives.	Army	6	0	1
	Navy	21	0	2
	Marine Crops	6	0	1
	Air Force	18	0	2
Development of Plan for Authoring and Managing Information				
Prerequisites				
1. Objectives, instructional activities, methods, and media have all been specified.	Army	0	6	1
	Navy	5	15	3
	Marine Corps	0	5	2
	Air Force	0	18	2
Procedures				
1. Specify the content and design of each lesson.	Army	3	2	2
	Navy	13	6	4
	Marine Corps	1	3	3
	Air Force	14	4	2
2. Specify how the instruction will be conducted and managed.	Army	6	0	1
	Navy	21	0	2
	Marine Corps	6	0	1
	Air Force	17	1	2
Review and Selection of Existing Materials				
Prerequisites				
1. Instructional activities have been specified.	Army	0	5	2
	Navy	5	15	3
	Marine Corps	0	5	2
	Air Force	0	18	2
2. Methods of training have been specified.	Army	5	0	2
	Navy	20	0	3
	Marine Corps	6	0	1
	Air Force	18	0	2
3. Media have been specified.	Army	3	2	2
	Navy	16	3	4
	Marine Corps	2	0	5
	Air Force	16	2	2

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Review and Selection of Existing Materials *(Continued)*				
Procedures				
1. Examine existing instructional materials to determine whether any meet the specifications for instructional activities, methods, and media.	Army	1	4	2
	Navy	5	14	4
	Marine Corps	0	5	2
	Air Force	4	13	3
2. Select materials or parts of materials that meet the specifications, or which could be efficiently revised.	Army	1	4	2
	Navy	6	13	4
	Marine Corps	0	5	2
	Air Force	4	13	3
Authoring of Instruction				
Prerequisites				
1. Objectives have been grouped and sequenced.	Army	5	0	2
	Navy	21	0	2
	Marine Crops	6	0	1
	Air Force	17	0	3
2. Instructional activities have been specified.	Army	0	5	2
	Navy	5	15	3
	Marine Corps	0	5	2
	Air Force	0	17	3
3. Methods of training have been specified.	Army	5	0	2
	Navy	20	0	3
	Marine Corps	6	0	1
	Air Force	17	0	3
4. Media have been specified.	Army	3	2	2
	Navy	16	2	5
	Marine Corps	2	3	2
	Air Force	16	1	3
5. Lesson structure and content have been planned.	Army	2	2	3
	Navy	14	4	5
	Marine Corps	1	4	2
	Air Force	16	1	3
Procedures				
1. Develop lean instruction.	Army	1	3	3
	Navy	9	10	4
	Marine Corps	0	1	6
	Air Force	1	14	5

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Authoring of Instruction *(Continued)*				
2. Try out instruction on small number of persons representative of students.	Army	2	3	2
	Navy	7	12	4
	Marine Corps	0	2	5
	Air Force	1	14	5
3. Revise and augment instruction as necessary.	Army	1	3	3
	Navy	3	11	9
	Marine Corps	0	2	5
	Air Force	1	14	5
Validation of Instruction				
Prerequisites				
1. Objective-referenced achievement tests are available.	Army	5	0	2
	Navy	20	0	3
	Marine Corps	6	0	1
	Air Force	16	0	4
Procedures				
1. Specify achievement test validation criteria (number and percent of persons in validation sample required to pass tests).	Army	0	3	4
	Navy	7	9	7
	Marine Corps	0	3	4
	Air Force	0	15	5
2. Specify additional validation criteria.	Army	0	3	4
	Navy	4	11	8
	Marine Corps	0	3	4
	Air Force	0	15	5
3. Present instruction, administer achievement tests, analyze results, revise instruction, and repeat cycle until validation criteria are met.	Army	2	2	3
	Navy	7	11	5
	Marine Corps	0	3	4
	Air Force	0	15	5
Internal Evaluation				
Prerequisites				
1. Records of students' performance on achievement tests are available.	Army	3	0	4
	Navy	9	0	14
	Marine Corps	3	0	4
	Air Force	13	1	6

(Continued)

		Present/ Accomplished	Absent/ Not Accomplished	Not Applicable/ Not Determined
Internal Evaluation *(Continued)*				
2. Documentation is available of what occurred during the ISD process, including rationales for decisions, departures from standard procedures, etc.	Army	0	3	4
	Navy	5	6	12
	Marine Corps	0	3	4
	Air Force	8	7	5
Procedures				
1. Specify evaluation criteria (number and percent of persons required to pass tests, etc.).	Army	0	3	4
	Navy	1	10	12
	Marine Corps	0	3	4
	Air Force	3	12	5
2. Identify the causes of shortcomings in the instruction and specify revisions.	Army	1	2	4
	Navy	5	7	11
	Marine Corps	0	3	4
	Air Force	9	6	5
External Evaluation				
Prerequisites				
1. Access to supervisors and job incumbents is possible soon after arrival of graduates on the job.	Army	3	0	4
	Navy	8	0	15
	Marine Corps	3	0	4
	Air Force	10	1	9
Procedures				
1. Construct evaluation instruments (mail questionnaires, job sample tests, interview guides, etc.).	Army	2	3	2
	Navy	8	5	10
	Marine Corps	3	0	4
	Air Force	6	7	7
2. Collect evaluation information.	Army	0	3	4
	Navy	7	5	11
	Marine Corps	3	0	4
	Air Force	6	7	7
3. Analyze data, identify causes of deficiences, and specify revisions.	Army	0	2	5
	Navy	3	7	13
	Marine Corps	1	1	5
	Air Force	4	7	9